The nexus between education and poverty reduction in Ghana from 2013 to 2017
Anthony Abaidoo

Abstract: Generally, poverty levels in Ghana have reduced over the past decade. Still, extreme poverty increased from 2.2 million in 2013 to 2.4 million in 2017. This study was conducted to assess the nexus between education and poverty reduction in Ghana. Data from the Ghana Living Standard Survey (GLSS) rounds six (2012/2013) and seven (2016/2017) with a total sample size of 30,781 was used. Using the probit and logit models and two-stage least square estimation, the findings confirmed that there is a significant negative relationship between education and poverty reduction. Additionally, it was revealed that household heads with higher levels of education (tertiary) are less likely to be poor as compared with their counterparts with low levels of education (basic level). Again, the probability of household heads being poor was high among those in the rural areas. Households with large family size were more likely to be poor. Considering the findings of the study policy makers should consider education as important driver for poverty reduction and ensure that majority of the populace have access to higher level of education, especially tertiary.

Subjects: Education - Social Sciences; Economics and Development; Economics; Education Studies; Education Policy & Politics

Keywords: Poverty reduction; probit and logit models; education and poverty; Ghana

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PUBLIC INTEREST STATEMENT
Poverty alleviation continue to be a global concern. Due to the multi-dimensional nature of poverty, several poverty-reduction strategies have been suggested and implemented but education has been identified as key driver. Education helps to improve the skills and productivity of workers, thereby increasing the earnings and standard of living. The study focused on the role education in poverty reduction in Ghana from 2013 to 2017. The study revealed that education remains the most important tool for poverty reduction in Ghana. Consequently, policy makers, governments and international bodies should continue to enact policies, which will improve access and quality of education especially in Sub-Saharan Africa.
1. Introduction

Poverty reduction remains a global concern for all governments and most international organizations. Because of this, world leaders signed a declaration, the Millennium Development Goals (MDGs) in September 2000 with a critical objective of eradicating extreme poverty and hunger by the year 2015 (United Nations Development Programme, 2015). According to the former UN Secretary General, Ba Kin-Boon, the MDGs was one of the most important poverty reduction strategies, which has helped to lift more than one billion people out of extreme poverty [US $1.25] (United Nations Development Programme, 2015). Despite this progress, poverty levels are still high, especially in developing countries. In Sub-Saharan Africa, more than 40 percent still live in extreme poverty (United Nations Development Programme, 2015). The trend is disturbing because whiles global extreme poverty is declining in all regions, it is increasing in Sub-Saharan Africa (Wadhwa, 2018) and the World Bank (2018) has predicted that by the year 2030, “nearly 9 of every 10 people in extreme poverty will be living in Sub-Saharan Africa”.

The poverty rate in Ghana from 1991 to 2012 decreased from 52.5 percent to 24.4 percent (almost half) with the rate of decline in extreme poverty being even more rapid; it declined by 28 percent (from 37.6 percent to 9.6 percent) within the same period (Ghana Statistical Service, 2014b; Molini & Pierella, 2015). Since 2012, the rate of decline in poverty levels in Ghana has been minimal. From 2012 to 2017, poverty levels reduced by only 0.8 percent. Additionally, the number of people living in extreme poverty increased from 2.2 million in 2013 to 2.4 million in 2017 (Ghana Statistical Service, 2018b).

Policy makers and key stakeholders such as GSS have emphasized that much needs to be done in Ghana to achieve Sustainable Development Goal (SDG) of ending poverty in all forms by 2030. Ending poverty of all forms especially in Ghana require conscious effort because of the multi-dimension nature of poverty (characterized by literacy, health, income, malnutrition and insecurity) in the country (Ghana Statistical Service, 2018b).

Molini and Pierella (2015) observed that poverty reduction in Ghana from 1991 to 2012 was as a result of three key factors: structural transformation, growing skill of the labour force and geographical mobility. They stressed that education was the most important driver which improved employees’ productivity and access to better jobs thereby having better earnings. Several studies have also confirmed the significant role of education on poverty reduction (Bilenkisi et al., 2015; Botha, 2010; Pervez, 2014; Rolleston, 2011).

This study was conducted primarily to assess the nexus between education and poverty reduction in Ghana from 2013 to 2017. The period as already indicated has seen an increase in poverty levels in Ghana hence the need to address this problem. To tackle this issue, it was hypothesized that higher levels of education have positive effect on poverty reduction in Ghana. There is also the need to provide the operational definition of poverty for this study. This was necessary because several definitions of poverty have been given by different authors. The United Nations (n.d.) posits that the definition of poverty is not narrowed to only the lack of production resources and income, but it also includes limited access to education, malnutrition, hunger, and lack of participation in decision making as well as social discrimination. However, the highly recognized and accepted definition of poverty is defined by using an international poverty line of US$1.90 per day (World Bank, 2020). For this study, the Ghana Statistical Service definition was adopted. A poor or non-poor person in Ghana is identified by computing food and non-food expenditure to determine a poverty line. There are two poverty lines used in Ghana: upper poverty line (GHC1,314 per adult equivalence per year) and lower poverty line (GHC792.05 per adult equivalence per year). The focus of this paper is on upper poverty (Ghana Statistical Service, 2018a, 2014a).

The entire study is structured into five sections: the first section focuses on the introduction of the study, section two provides the theoretical framework and literature review. In contrast, the
third section presents the data and methodology. Section four presents the results and discussion and the conclusion and policy implication is presented in the final section.

2. Theoretical framework

The theoretical framework used in the study is the Human Capital Theory. The human capital theory regard education as an important driver for poverty reduction and economic growth (Jandhyala, 2002). Scholars such as Alfred Marshall (1920) and Adam Smith (1776) are credited with the human capital theory but it was Theodore Schultz (1961) who emphasized the role of human capital in economic growth. Mincer (1972), Becker (1964), Denison (1962), and Schultz (1961) have all given different perspective on the formation of human capital but they place education as a top priority in economic growth theories.

Proponents of this theory believe that human capital leads to higher economic growth and education is the most important driver (Lucas, 1988; Mankiw et al., 1992; Romer, 1990; Schultz, 1961) although there are other components of human capital such as on the job training, health, occupational mobility and skills. That is, investment in education leads to the formation of human capital, which is significant for economic growth. Romer (1989) said human capital constitutes the “stock of skills and productive knowledge embodied in people” (p. 682). These skills acquired improves the productivity of the individual thereby having a positive effect on earnings. It should be emphasized that the human capital theory reorganizes the direct (e.g., good nutrition and health) and indirect effect such as improved productivity and earning of education on development.

From the aforementioned, human capital theory emphasizes the significance of education as a key component of human capital formation and its impact on productivity of workers and their earnings. Based on this channel, the conceptual framework below has been adopted.

Per the theory and studies conducted, human capital has a positive impact on poverty reduction but has two major channels, direct and indirect. The focus of this paper is on the impact of education on poverty reduction. The link between education and poverty reduction as indicated from the Figure 1 above is not direct. Education helps to increases workers productivity which improves their earnings and reduces poverty. It should be emphasized that Human capital is largely affected by the quality of education. As reported by the World Bank (2018), majority of children are schooling but not learning. This has led to what the World Bank term as learning poverty—which means the “inability to read and understand a simple text before age 10” (World Bank, 2018). It is clear that if this issue is not addressed it will lead to a human capital deficit which will affect the positive impact of education on poverty reduction as found in the literature.
2.1. Brief overview of education system in Ghana

Ghana’s education system runs from basic to the tertiary level. There are four levels with three terminal points. It begins with the pre-school, followed by six years primary school and then 3 years Junior High School (JHS). This level ends the first terminal point upon which a student enters the Senior High School or Vocation/Technical School to complete the second terminal point. The final stage and third terminal point is the tertiary level which comprises of universities/colleges, polytechnics, teacher and nursing training and other post-secondary institution that award diploma certificates (Ministry of Education, 2015).

Over the past decade, Ghana has witnessed a number of educational programmes and policies to increase enrolment and quality of delivery: Free Senior High School; Free Compulsory Basic Education; Access to Functional Literacy Programme; Capitation Grant; and School Feeding Programme (Ghana Statistical Service, 2018b, 2014b). These programmes and policies have tremendously helped to increase the net school attendance rate from the primary to high school level (Ghana Statistical Service, 2018b) but the quality remains questionable.

2.2. Literature review

Globally, extensive studies have been conducted on the nexus between education and poverty reduction with different data sets and methods. Almost all the literature found an inverse relationship between education and poverty but the degree of magnitude and how other socioeconomic variables such as age, gender, income level and location differ.

Studies conducted in developing countries have found that education contribute to poverty reduction but due to the poor quality of education in these countries the overall benefits of education is not realized. For example, in Iran, Araf (2011), found that significant rural structural barriers such as inadequate skills and knowledge of teachers and inadequate teaching and learning materials hinders the impact of education on poverty reduction in rural Iran. In Turkey, it has been established there is an inverse relationship between the probability of being poor and education. Specifically, household heads with higher level of education are less likely to be poor but vocational and technical training were found to be a better poverty-reducing tool than high school. Age of household heads has also been found to have a negative relationship with the probability of being poor in Turkey (Bilenkisi et al., 2015). Using data set in Pakistan from 1998 to 2002, Awan et al. (2011), found that in Pakistan, male household heads have the opportunity of skipping the poverty line and higher levels of education reduces the probability of being poor. Pervez (2014) applying the Augmented Dickey-Fuller (ADF), Causality and Johasen Co-integration method with time series data from 1972 to 2006 Pakistan Economic Survey, concluded that gross enrolment at the secondary level and literacy rate have a negative significant impact on poverty in the long-run but life expectancy has a positive impact. In Fiji, Gounder and Xing (2012), reported that additional skills obtained through formal education has a significant impact on household income levels. The empirical evidence from these developing countries shows that education has an impact on poverty reduction but the link is not straightforward.

Moreover, studies conducted in Sub-Sahara Africa have similar findings of the developing countries. Ogundari and Oramularan (2014) used the Double Hurdle (DH) and Quantile Regression (QR) models to assess the impact of education on household welfare in Nigeria. They found that returns to education are substantially higher at the tertiary levels as compared to primary and secondary. In South Africa, it was revealed that household heads with primary education are 6.7% less likely to be poor; secondary education are 20.76% less likely and those with post-secondary education are 37.19% less likely to be poor. Again, female heads, those in the rural areas and blacks were found to be more vulnerable (Botha, 2010). Applying logistic regression analysis and using data from the Cameroonian 2001 Household Survey, Njong (2010) reported similar results. It was noticed that educational attainment and experience of the employed reduces the probability of being poor but male education attainment has significant impact on poverty-reduction than their female
counterpart. Again, Wedgwood (2007), concluded getting children to school alone is not enough for poverty reduction. The findings from this study showed that the quality of education on Tanzania has been compromised hence the total benefits from education have not realized.

In Ghana, Addai-Boateng (2019), used Ada East district as a case study to assess poverty and development: the role of education on poverty reduction. The study adopted the mixed research design and randomly selected 85 household from 5 communities. It was revealed that almost all the respondents (91.8%) recognized education as poverty-reduction tool. However, the respondents disclosed that the goal of education as poverty-reduction tool will be sustainable if the quality of education is enhanced. Similarly, Dzidza et al. (2018), concluded that educational attainment have invariably impacted poverty levels in Ghana.

Moreover, Rolleston (2011) examined the role of education in determining welfare and poverty in Ghana. The study used data from the Ghana Living Standard Survey (GLSS) round 3 to 5 and adopted the OLS and random effect models. Household welfare had a negative significant effect on household size but other variables such as gender, location (urban/region), and level of education had a positive relationship with household welfare. The results revealed that the various levels of education (primary—tertiary) play an important role in determining household welfare with higher levels of education having a more significant impact. In addition to the quality of education that has been emphasized in order for education to achieve its objective as a poverty-reduction tool (Addai-Boateng, 2019; Palmer et al., 2007), Palmer, Wedgwood and Hagman (2007) re-echoed the need for a good enabling environment. This is very important because in Iran, lack of educational materials, lack of access to high school, immigration and non-participation were among the factors found as barriers hindering education from achieving its poverty-reducing goal (Aref, 2011). Focusing on six countries, Ghana, Kenya, South Africa, India, Tanzania and Rwanda, Palmer et al. (2007), concluded that education has a greater impact on development and poverty reduction. This is not entirely different from Janjua and Kamal (2011) who found that in developing countries, education is the most important contributor to poverty reduction while income plays a moderate role.

3. Data and methodology

3.1. Sources of data

The data used for this study was extracted from Ghana Statistical Service’s (GSS) Ghana Living Standard Survey (GLSS) which is accessible via https://www.statsghana.gov.gh/gssdatadownloads page.php. GSS with support from the World Bank has been conducting this survey since 1987 with the primary aim of measuring the well-being and assessing the living condition of the population. The first round was conducted in 1987/1988 and the second round in 1988/1999. The third, fourth, fifth and sixth rounds were conducted in 1991/1992, 1998/1999, 2005/2006 and 2012/2013, respectively, and the seventh round in 2016/2017. The GLSS data are gathered at district, regional, urban/rural levels to assess respondent’s demographic characteristics and poverty levels within a period of 12 months.

Data from the last two rounds (GLSS 6 and 7) were used in this study because the questionnaires used within the period was identical which makes it possible for comparison. Data gathered within this period centered on demographic characteristics of the population, health, education, employment, child labour household agriculture, migration, housing condition, prices of consumer items and household income. Probability sampling techniques was used to select 14,009 households in 1,000 enumeration areas for GLSS 7 (Ghana Statistical Service, 2018b) and the same technique was adopted for GLSS 6 to select 16,722 households from 1,200 enumeration areas (Ghana Statistical Service, 2014b).
3.2. Model specification

In this study, the binary probit and logit model was adopted. This model is used when there is a need to make choice between two alternatives and takes on the values of 0 and 1 (Hill et al., 2011). It is one of the most common techniques used in applied economics (Katchova, 2013a). In this study, the binary outcome-dependent variable is whether a household is poor or non-poor.

Following Hill et al. (2011), if poor is represented by Pov, then the household’s indicator variable is:

\[ Pov = \begin{cases} 1 & \text{if yes} \\ 0 & \text{if no} \end{cases} \quad (1) \]

If \( p \), shows the probability that a household is poor, then \( p(Pov = 1) = p \); and if a household is non-poor, \( p(Pov = 0) = 1-p \). The probability function for this model is therefore:

\[ f(Pov) = p^y(1-p)^{1-y}, Pov = 0, 1 \quad (2) \]

Where \( p \), is the probability that \( Pov \), is equal to one and the expected value \( E(Pov) = p \); variance \( (Pov) = p(1-p) \).

One of the best ways to model binary choice is to use the Linear Probability Model (LPM). This model is multiple regressions with binary dependent variable (Wooldridge, 2012). Although the study used LPM, it has some limitations: First, the predicted probabilities is not limited between 0 and 1. It assumes that the marginal effect of changes in continuous variables are constant, which cannot be the case for probability model. Finally, the variance of the error term varies from one observation to another, there is heteroscedasticity (Hill et al., 2011). Due to these limitations, the study also adopted the logit and probit models which have predicted values limited between 0 and 1 (Katchova, 2013b).

3.3. Empirical model

From the review of extensive literatures, the following explanatory variables were included in the model estimation; Table 1 household head highest level of education, household head employment status, household head gender, household head marital status, household head age, household head location (rural/urban), household head region of residence and household size.

The general economic model is given as:

\[ f(Pov) = f(Edu, Emp, Sex, Ms, Age, Loc, Reg, Hs) \quad (3) \]

The specific Linear Probability Model (regression model) is:

\[ Pov = \beta_0 + \beta_1 Edu + \beta_2 Emp + \beta_3 Sex + \beta_4 Ms + \beta_5 Age + \beta_6 Loc + \beta_7 Reg + \beta_8 Hs + \mu \quad (5) \]

The Probit Model is:

\[ pPov = p(Pov) = \phi(\beta_0 + \beta_1 Edu + \beta_2 Emp + \beta_3 Sex + \beta_4 Ms + \beta_5 Age + \beta_6 Loc + \beta_7 Reg + \beta_8 Hs) \quad (6) \]

The Logit Model is:

\[ pPov = p(Pov) = \Lambda(\gamma_0 + \gamma_1 Edu + \gamma_2 Emp + \gamma_3 Sex + \gamma_4 Ms + \gamma_5 Age + \gamma_6 Loc + \gamma_7 Reg + \gamma_8 Hs) \quad (7) \]

In the estimation of the probit and logit models, the Maximum Likelihood Method (MLM) was used. An interesting feature of MLM estimator is that it is normally distributed, consistent and best in the sense that no computing estimator has smaller variance (Hill et al., 2011).

In addition to reporting the coefficients, the marginal and average effects are also reported when using the probit and logit models (See Appendix A for the computation for the marginal and average
effects for the three models). In the absence of endogeneity, the causal effect of education on poverty reduction can easily be interpreted but studies have found that there is a problem of endogeneity which if not addressed lead to inconsistent estimates (Ergun & Goksu, 2013; Wooldridge, 2012). This kind of problem has always been resolved by using instrumental variables methodology.

To obtain consistent estimate, the problem of endogeneity caused by the reverse causality between these two variables should be addressed. Elsewhere increase of minimum school age (Harman & Walker, 1995); season of birth (Angrist & Kuegner, 1991); and proximity to school (Card, 1993) have been used as instruments to solve the causality between education and poverty/wage. In line with Card (1993), proximity to school measured in terms of travelling time was selected as the instrumental variable. The assumption is that household closer to educational institutions are more likely to obtain higher levels of education than those far away.

From equation (2), the structural equation is the estimate for the Two Stage Least Regressors (2SLS) are:

\[
\text{FirstStage : Edu} = \gamma_0 + \gamma_1 \text{Stt} + \gamma_2 \text{Emp} + \gamma_3 \text{Sex} + \gamma_4 \text{Ms} + \gamma_5 \text{Age} + \gamma_6 \text{Loc} + \gamma_7 \text{Reg} + \gamma_8 \text{HS} + \epsilon \quad (8)
\]

\[
\text{SecondStage : Pov} = \beta_0 + \beta_1 \text{Edu} + \beta_2 \text{Emp} + \beta_3 \text{Sex} + \beta_4 \text{Ms} + \beta_5 \text{Age} + \beta_6 \text{Loc} + \beta_7 \text{Reg} + \beta_8 \text{HS} + \mu
\]

From equation (8), Stt is the distance of school measured in terms of travelling time in minutes and is the vector instrument variable.

4. Results and discussion

4.1. Descriptive statistics

Descriptive statistics for the variables used in the study is presented in Table 2. Frequencies and percentages are used to explain the categorical variables while the continuous variables are explained by using mean, standard deviation, minimum and maximum.

Household head’s with tertiary as their highest level of education decreased from 1,274 (7.60%) in 2012 to 748 (5.24%) in 2017. There was a marginal increase of 0.01% in Senior Secondary School (SSS) and a 2.59% increase in vocation/technical/teacher training within the period (See Tables A1 and A2 for further details). This may be as a result of the Free Senior High School (SHS) policy introduced by the Ghana government in September 2017. However, from Table 2, household heads with their highest level of education below BECE constituted the highest percentage (40.19%). This high figure is disturbing because Bilenkisi et al. (2015) reported that households with less form of education have a high probability of being poor.

Using the upper poverty line, poverty levels from 2013 to 2017 decreased by 1.98% (from 2,643 [15.76%] to 1,931[13.78%]). A cross-tabulation of poverty status and location, indicated that poverty levels is dominant in rural areas in Ghana (see Table A3 in Appendix A). Out of 30,781 household head, 26,949 (87.55%) are employed and 3,823(12.45) are unemployed. The average household head age was 46.82 years with a minimum and maximum age of 16 years and 99 years respectively. Household size had 1 as minimum and 22 as maximum with an average of 5.26. The average travelling distance to a school is 16.94 minutes and the maximum is almost an hour (59 minutes). The implication is the educational attainment of students with more travelling time is likely to be negatively affected.

4.2. Regression modeling results

4.2.1. OLS results

Table 3 provides results from the ordinary least square regression (OLS) regression model of poverty on household head’s highest level of education and other controlled variables. Findings
Table 1. Explanation of variables

| Variables | Explanation |
|-----------|-------------|
| Pov       | This is a binary outcome dependent variable with $1 = $ poor and $0 = $ non-poor. The analysis of poverty in Ghana focuses on consumption poverty which classifies a poor person as someone who is unable to afford basic consumption need including food and non-food items. According to the GLSS 7 Poverty Trends in Ghana, 2015–2017 report, a poor or non-poor person in Ghana is identified by estimating the expenditure of food and non-food needs for the individual. The computed expenditure is termed as the poverty line. Two poverty lines have been adopted in Ghana; upper poverty line (GHC 1,314 per adult equivalence per year) and lower poverty line (GHC792.05 per adult equivalence per year). Because Ghana has done extremely well to push majority of her populace out of extreme poverty, this study used the upper poverty line which is also known as absolute poverty (Ghana Statistical Service, 2018b; Ghana Statistical Service, 2014b). |

Independent variables

| Edu       | This represent the highest level of education attained by the head of household. |
| Emp       | This is household head’s employment status with a dummy for 1 if employed and 0 for unemployed and not in labour force. |
| Sex       | Household head gender with a dummy for 1 if male and 0 for female |
| Ms        | Household head marital status with a dummy for 1 if married and 0 for otherwise |
| Age       | Household head age measures in years |
| Loc       | Household head location with a dummy for 1 if rural and 0 for urban |
| Reg       | Household head region of residence. |
| Hs        | Household Size |

Note: Household head is the person acknowledge as such by members of the household and who is usually responsible for the upkeep maintenance of the household. Household is defined as a person or group of related or unrelated person who live together in the same housing unit, sharing the same housekeeping and cooking arrangements and are considered as one unit, who acknowledge an adult male or female as the head of the household (Ghana Statistical Service, 2018b, 2014b).

Source: Authors Own Construct (June, 2020)

from the data revealed that for all levels of education, there is an inverse relationship between household head’s level of education and poverty status. For every additional level of education achieved by the head of household, poverty level is likely to reduce by 3.0% (GLSS6), 2.7% (GLSS 7) or 3.0% (pooled). Detailed analysis of household head’s highest level of education shows that higher levels of education predicts lower poverty level. From the pooled data, BECE reduces poverty by 12.3%, MSLC reduces it by 11.3%, SSS and Voc/Tech also reduces poverty by 19.6% and 22.2% respectively. Tertiary is the highest predictor of poverty reduction by 22.5%. These findings are consistent with several studies (Awan et al., 2011; Bilenkisi et al., 2015; Botha, 2010) but the magnitude differs. For example, using GLSS 3–5, Rolleston (2011) noticed that MSLC improves household welfare by 17.3%; SSS by 22.0% and bachelor’s degree by 71.0%.

With the exception household head’s age, all the explanatory variables were significant for the pooled data. For any additional household member, a household is 0.1% (GLSS 7) or 0.31% (GLSS 6) and 6) or 0.241% (pooled) more likely to be poor. This findings is so because a larger household require extra income to meet the additional needs of all members. Additionally, household heads
may have to share their limited resources among the large household members. Irrespective of a household region, they are likely to be 0.5% (pooled) poor. The probability is less for GLSS 6 (0.03%) by 2% higher for GLSS 7. Household heads in the rural area are 16.4% (GLSS 7) or 12.2% (GLSS 6) or 14.1% (pooled) more likely to be poor than their counterparts in the urban areas. This figure is not surprising because poverty level is noted to be rural phenomena in Ghana (Ghana Statistical Service, 2018b). Apart from GLSS 7, where employment has an inverse relationship with poverty levels, GLS 6 and the pooled results have a positive relationship with the poverty level. For GLSS 7, household head with employment is 0.3% less likely to be poor but for GLSS 6, household head with employment is 0.28% more likely to be poor and the pooled results also show that such a household is 1.3% more likely to be poor. This results inconsistent with theory as one would expect those with some form of employment to be less likely to be poor than their unemployed counterparts. However, it could be that these people are employed in the formal sector with minimal wage or informal sector with irregular minimal income.

**Table 2. Descriptive statistics for pooled data (GLSS 7 and 6)**

| Variables                          | Mean | Std.Dev. | Min | Max |
|-----------------------------------|------|----------|-----|-----|
| Poor                              | 0.148| 0.255    | 0   | 1   |
| Employment Status (1 = Employed)  | 0.875| 0.33     | 0   | 1   |
| Sex (1 = Male)                    | 0.707| 0.454    | 0   | 1   |
| Marital Status (1 = Married)      | 0.681| 0.465    | 0   | 1   |
| Age                               | 46.82| 13.67    | 16  | 99  |
| Location (1 = Rural)              | 0.44 | 0.496    | 0   | 1   |
| Household Size                    | 5.264| 2.73     | 1   | 22  |
| Travelling distance from school   | 16.94| 14.72    | 0   | 59  |
| Highest level of education        | Freq | Percentage| Cum. |     |
| None                              | 12,372| 40.19    | 40.19|     |
| BECE                              | 4,504 | 16.63    | 54.83|     |
| MSLC                              | 7,099 | 23.06    | 77.89|     |
| SSS/Secondary                     | 2,750 | 8.93     | 86.82|     |
| Voc/Teach/Teacher                 | 2,034 | 6.61     | 93.43|     |
| Tertiary                          | 2,022 | 6.57     | 100.00|    |
| Region                            |      |          |     |     |
| Western                           | 3,049 | 9.91     | 9.91|     |
| Central                           | 2,920 | 9.49     | 19.39|    |
| Greater Accra                     | 3,322 | 10.79    | 30.18|    |
| Volta                             | 2,941 | 9.55     | 39.74|    |
| Eastern                           | 3,199 | 10.39    | 50.13|    |
| Ashanti                           | 3,716 | 12.07    | 62.20|    |
| Brong Ahafo                       | 2,939 | 9.55     | 71.75|    |
| Northern                          | 3,111 | 10.11    | 81.86|    |
| Upper East                        | 2,818 | 9.15     | 91.01|    |
| Upper West                        | 2,766 | 8.99     | 100.00|   |

Number of observation = 30,781

Source: Authors Own Construct (June 2020)
Table 3. Household poverty level and education (OLS Model)

| Variables                  | GLSS 7   | GLSS 6   | Pooled   |
|----------------------------|----------|----------|----------|
| Highest level of education | -0.027(0.02)*** | -0.032(0.002)*** | -0.030(0.001)*** |
| Details of education       |          |          |          |
| BECE                       | -0.093(0.008)*** | -0.150(0.008)*** | -0.123(0.006)*** |
| MSLC                       | -0.094(0.007)*** | -0.133(0.006)*** | -0.113(0.005)*** |
| SSS                        | -0.185(0.010)*** | -0.208(0.010)*** | -0.196(0.007)*** |
| Voc/Tech                   | -0.201(0.011)*** | -0.241(0.012)*** | -0.222(0.008)*** |
| Tertiary                   | -0.209(0.013)*** | -0.242(0.010)*** | -0.225(0.008)*** |
| Employment Status (1 = Employed) | -0.003(0.008) | 0.028(0.009)*** | 0.013(0.006)*** |
| Sex (1 = Male)             | -0.016(0.007)**  | 0.011(0.007)**  | -0.003(0.005)   |
| Marital Status (1 = Married) | -0.010(0.007)*       | -0.047(0.008)*** | -0.021(0.005)*** |
| Age                        | 0.000(0.000)       | 0.000(0.000)       | 0.000(0.000)       |
| Location (1 = Rural)       | 0.164(0.006)*** | 0.122(0.005)*** | 0.141(0.004)*** |
| Region                     | -0.007(0.001)*** | -0.003(0.001)*** | -0.005(0.001)*** |
| Household Size             | 0.016(0.001)*** | 0.031(0.001)*** | 0.024(0.0001)*** |
| Constant                   | 0.096(0.016)*** | 0.034(0.016)*** | 0.059(0.011)*** |
| Number of Observations      | 14,009    | 16,722    | 30,781    |
| Prob>Chi²                  | 0.0000    | 0.0000    | 0.0000    |
| Adj R²                     | 0.12      | 0.14      | 0.13      |

Note. The standard errors are within the parenthesis. *p < 0.1, **p < 0.05, ***p < 0.01
Source: Authors Own Construct (June 2020)

4.2.2. Probit and logit model

Table 4 and 5 show results estimation for the probit and logit models with results reported based on marginal effects. The results from the probit model show that a household is less likely to be poor if there is some form of education. This is because all levels of education have a significant negative relationship with the probability of a household being poor. The findings agree with what Botha (2010) found in his studies. From the data, Household head with BECE is 9.3% less likely to be poor (GLSS 7); 58.0% less likely to poor (GLSS 6) and for the pooled 48.5% less likely to be poor. MSLC is not significantly different from BECE but the variance is wide as a household head attains higher levels of education. From GLSS 6, heads with SSS is 96.6% likely to be poor but is 18.5 for GLSS 6. Using the pooled data, it not likely for a household with tertiary education to be poor (~1.47). Bilenikisi et al. (2015) reported similar findings where they concluded that in South east of Turkey, household heads with tertiary are not likely (~1.44) to be poor. In Nigeria, Ogundari and Aromolaran (2014) also concluded that returns to education are substantially higher at the tertiary level. The impact of household head highest level of education was improved by using the probit model. The logit and probit models correctly predict 84.77% of values and the rest are misclassified. Results for the logit model is presented in Appendix A.

Probability of household head being less likely poor with employment is 0.06% (GLSS 7) but a household head with employment in 2013 (GLSS 6) was 0.28% more likely to be poor. From the pooled results, the probability of a male household head being less likely to be poor is 0.02% and those married are 0.09% less likely to be poor. This finding is in line with Awan et al. (2011) who concluded that being a male head of household serves as an advantage to be above the poverty line. Household heads in the rural areas have a probability of 13.0% (GLSS 7), or 10.4% (GLSS 6) or 11.7% (Pooled) being more poor than those in urban areas. Moreover, the probability of
Table 4. Household poverty level and education (Probit Model with marginal effect)

| Variables                      | GLSS 7          | GLSS 6          | Pooled          |
|--------------------------------|-----------------|-----------------|-----------------|
| Highest level of education     | −0.036(0.001)***| −0.042(0.009)***| −0.040(0.001)***|
| Details of education           |                 |                 |                 |
| BECE                           | −0.093(0.008)***| −0.580(0.037)***| −0.485(0.027)***|
| MSLC                           | −0.094(0.008)***| −0.492(0.029)***| −0.438(0.022)***|
| SSS                            | −0.185(0.007)***| −0.966(0.055)***| −1.007(0.044)***|
| Voc/Tech                       | −0.201(0.006)***| −0.138(0.094)***| −1.408(0.068)***|
| Tertiary                       | −0.209(0.005)***| −0.141(0.082)***| −1.468(0.072)***|
| Employment Status (1 = Employed)| −0.006(0.006)   | 0.028(0.009)*** | 0.011(0.005)**  |
| Sex (1 = Male)                 | −0.011(0.005)** | 0.007(0.007)    | −0.002(0.004)   |
| Marital Status (1 = Married)   | −0.005(0.005)   | −0.026(0.008)***| −0.009(0.004)** |
| Age                            | 0.000(0.000)    | 0.000(0.000)    | 0.000(0.000)    |
| Location (1 = Rural)           | 0.130(0.004)*** | 0.104(0.005)*** | 0.117(0.003)**  |
| Region                         | −0.010(0.001)***| −0.005(0.001)** | −0.007(0.001)** |
| Household Size                 | 0.013(0.001)*** | 0.024(0.001)*** | 0.019(0.001)*** |
| Number of Observations         | 14,009          | 16,722          | 30,781          |
| Prob>Chi²                      | 0.0000          | 0.0000          | 0.0000          |
| Pseudo R²                      | 0.18            | 0.17            | 0.17            |

Note. The standard errors are within the parenthesis. *p < 0.1, **p < 0.05, ***p < 0.01
Source: Authors Own Construct (June 2020)

A household with a larger household size is 1.3% (GLSS 7), or 2.4% (GLSS6) or 1.9% (Pooled) more likely to be poor.

4.2.3. Instrumental variable estimation

The OLS estimates indicated that with an additional level of education attainment by household head, a household is 3 percent less likely to be poor. This figure increased by 1 percent by using the probit model. After instrumentation, household heads with some level of education are 16.5 percent less likely to be poor which is 13.5 and 12.5 higher than the OLS and probit coefficients, respectively. Similar results were found by Pervez (2014), Awan et al. (2011). Again, the sign for coefficient of household heads with employment is different from the OLS and probit estimation. The results show that household head with employment are 1.8% less likely to be poor than the unemployed.

4.2.3.1. Post estimation. Maximum likelihood estimation or Instrumental Variables (IV) are the possible solutions for endogeneity. However, the most preferred way to deal with endogeneity is to use instrumental variables with two stage least square estimation (Ergun & Goksu, 2013). Instrumental variables helps to produce consistent estimators (Wooldridge, 2012) but OLS produces better results if the instruments are weak (Ergun & Goksu, 2013). Hence, there is a need to test for endogeneity and the instruments used.

Endogeneity test was conducted by using the Durbin-Wu-Hausman test for endogeneity. Durbin-Wu-Husman test which is usually referred to as Hausman specification test is a commonly used test in linear repressors under the assumption of null hypothesis repressors(Hausman, 1978; Wu, 1973).
Table 5. 2SLS estimation model

| Variables                          | GLSS 7 | GLSS 6 | Pooled |
|------------------------------------|--------|--------|--------|
|                                    | 2SLS: FS for y2 (edu) | 2SLS: FS for y1 (poor) | 2SLS: FS for y2 (edu) | 2SLS: FS for y1 (poor) | 2SLS: FS for y2 (edu) | 2SLS: FS for y1 (poor) |
| Highest level of education (endo y2) | -      | -0.129(0.050)**  | -      | -0.222(0.060)**  | -      | -0.165(0.037)**  |
| Employment Status (1 = Employed)   | -0.186(0.061)**  | -0.003(0.018)**  | 0.067(0.062)  | 0.048(0.020)**  | -0.059(0.044)**  | 0.018(0.012)*  |
| Sex (1 = Male)                     | 0.697(0.051)**  | 0.064(0.037)*  | 0.923(0.050)**  | 0.174(0.058)**  | 0.802(0.035)**  | 0.103(0.032)**  |
| Marital Status (1 = Married)       | 0.349(0.051)**  | 0.019(0.022)  | 0.141(0.055)**  | -0.014(0.019)  | 0.262(0.037)**  | 0.013(0.014)  |
| Age                                | -0.001(0.001)  | 0.000(0.000)  | 0.002(0.001)*  | 0.001(0.001)*  | 0.001(0.001)  | 0.001(0.000)  |
| Location (1 = Rural)               | -0.736(0.041)**  | 0.097(0.038)**  | -0.889(0.036)**  | -0.001(0.002)  | -0.826(0.027)**  | 0.041(0.032)  |
| Region                             | 0.035(0.007)**  | -0.002(0.002)**  | 0.021(0.006)**  | 0.001(0.002)  | 0.027(0.004)**  | -0.001(0.001)  |
| Household Size                     | -0.027(0.008)**  | 0.009(0.002)**  | -0.091(0.007)**  | 0.013(0.006)**  | -0.065(0.005)**  | 0.013(0.002)**  |
| Travelling distance from school (IVS) | -0.006(0.001)**  | -      | -0.005(0.001)**  | -      | -0.006(0.001)**  | -      |
| Constant                           | 2.358(0.123)**  | 0.294(0.114)**  | 2.446(0.109)**  | 0.452(0.145)**  | 2.415(0.081)**  | 0.341(0.088)**  |
| Number of observations             | 4817  | 4817  | 6,902  | 6,902  | 11,718  | 11,718  |
| Adj R²                             | 0.15  | 0.15  | 0.18  | 0.18  | 0.17  | 0.017  |

Note. The standard errors are within the parenthesis. *p < 0.1, **p < 0.05, ***p < 0.01

Source: Authors Own Construct (June 2020)
The Durbin score and Wu-Hausman F statistics are all statistically significant, which means that the null hypothesis, which states that the repressors are exogenous is rejected (See Table A4 in Appendix A). Therefore, household head’s highest level of education is an endogenous repressor, and there is need to use instrumental variables approach.

Test for weak instruments revealed that Prob > F (0.000) is jointly statistically significant for the instrument used therefore the null hypothesis of weak instrument is rejected. This implies that the instrument used is not weak because the Robust F statistics is 52.17, which is larger than the rule of thumb of 10 (See Table A4 in Appendix A for further details).

5. Conclusion and policy implication
The study was conducted primarily to assess the nexus between education and poverty reduction in Ghana from 2013 to 2017. Data from the Ghana Living Standard Survey round 6 (2012/2013) with a sample size of 14,009 and round 7 (2016/2017) with a sample size of 16,722 was used. To achieve the objective for this study OLS regression, probit and logit models and two-stage least square estimation were adopted. Due to the problem of endogeneity, school distance measured in terms of travelling time was the instrument used to solve this problem. Findings from the data showed that poverty in Ghana is a rural phenomenon, and the average household size is 5.26 with high level of employment (87.55%) within the period under study.

All three models used found that there is an inverse significant relationship between education and poverty reduction. From the OLS model higher levels of education such as tertiary indicated less likelihood (22.5%) of being poor as compared to BECE of 12.3 percent. The probit and logit models also provided similar result. The probability of a household head with tertiary education is less likely to be poor as compared with their BECE and MSCL counterparts. Coefficients from the two-stage least square estimation revealed that household heads with higher forms of education are 16.5 percent less likely to be poor. Apart from age, all the other explanatory variables, location, household size, school distance (minutes), region, and marital status were all statistically significant.

Per the findings from this study the following recommendations have been suggested for policy making in Ghana and other countries with similar characteristics. It was revealed that higher levels of education such as tertiary has greater significant impact on poverty reduction compare to basic education. Although, Ghana government has introduced Free Senior High school Education, the study recommends that the government should minimize the barriers from high school to the tertiary level to increase enrolment at that level. The gap between school-to-work transitions could be addressed through constant review of the curriculum so that it can match with the changing needs of the society.

Although this study did not focus on quality education, the World Bank’s (2018) report revealed that schooling is not the same as learning. They opined that learning poverty, which is inability of children below the age 10 to read and understand simple text is a threat to country’s human capital development and poverty reduction. Due to this, the study recommends strongly that the Government of Ghana through the Ministry of Education should ensure that the quality of education in Ghana is enhanced through strict monitoring and supervision; teacher incentives; adequate and required professional development for school leaders and teachers; adequate learning and teaching materials; small classroom size; and good learning environment.

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**Table A1. Descriptive statistics for GLSS 7**

| Variables                     | Mean  | Std.Dev. | Min  | Max |
|-------------------------------|-------|----------|------|-----|
| Poor                          | 0.138 | 0.345    | 1    | 0   |
| Employment Status (1 = Employed) | 0.846 | 0.361    | 0    | 1   |
| Sex (1 = Male)                | 0.687 | 0.463    | 0    | 1   |
| Marital Status (1 = Married)  | 0.607 | 0.488    | 0    | 1   |
| Age                           | 47.256| 13.181   | 17   | 99  |
| Location (1 = Rural)          | 0.437 | 0.496    | 0    | 1   |
| Household Size                | 5.302 | 2.746    | 1    | 19  |
| Travelling distance from school | 17.817| 14.739   | 0    | 59  |

| Highest level of education     | Freq  | Percentage | Cum.   |
|-------------------------------|-------|------------|--------|
| None                          | 5,937 | 42.38      | 42.38  |
| BECE                          | 2,064 | 14.73      | 57.11  |
| MSLC                          | 2,883 | 20.58      | 77.69  |
| SSS/Secondary                 | 1,253 | 8.94       | 86.64  |
| Voc/Teach/Teacher             | 1,124 | 8.02       | 94.66  |
| Tertiary                      | 748   | 5.34       | 100.00 |

| Region                        | Freq  | Percentage | Cum.   |
|-------------------------------|-------|------------|--------|
| Western                       | 1,331 | 9.50       | 9.50   |
| Central                       | 1,318 | 9.41       | 18.91  |
| Accra                         | 1,398 | 9.98       | 28.89  |
| Volta                         | 1,367 | 9.76       | 38.65  |
| Eastern                       | 1,395 | 9.96       | 48.60  |
| Ashanti                       | 1,735 | 12.38      | 60.99  |
| Brong Ahafo                   | 1,318 | 9.41       | 70.40  |
| Northern                      | 1,409 | 10.06      | 80.46  |
| Upper East                    | 1,371 | 9.76       | 90.24  |
| Upper West                    | 1,367 | 9.76       | 100.00 |

Number of observations = 14,009

Source: Authors Own Construct (June, 2020)
Table A2. Descriptive statistics for GLSS 6

| Variables | Mean | Std.Dev. | Min | Max |
|-----------|------|----------|-----|-----|
| Poor      | 0.157| 0.364    | 0   | 1   |
| Employment Status (1 = Employed) | 0.9  | 0.299    | 0   | 1   |
| Sex (1 = Male) | 0.725| 0.446    | 0   | 1   |
| Marital Status (1 = Married) | 0.743| 0.436    | 0   | 1   |
| Age | 46.45 | 13.54    | 16  | 99  |
| Location (1 = Rural) | 0.443| 0.496    | 0   | 1   |
| Household Size | 5.232| 2.717    | 1   | 22  |
| Travelling distance from school | 16.34| 14.686   | 0   | 55  |

| Highest level of education | Freq | Percentage | Cum. |
|---------------------------|------|------------|------|
| None                      | 6,435| 38.37      | 38.37|
| BECE                      | 2,440| 14.55      | 52.92|
| MSLC                      | 4,216| 24.14      | 78.05|
| SSS/Secondary             | 1,497| 8.93       | 86.98|
| Voc/Teach/Teacher         | 910  | 5.43       | 92.40|
| Tertiary                  | 1,274| 7.60       | 100.00|

| Region | Freq | Percentage | Cum. |
|--------|------|------------|------|
| Western | 1,718| 10.24      | 10.24|
| Central | 1,602| 9.55       | 19.79|
| Accra  | 1,924| 11.47      | 31.27|
| Volta  | 1,574| 9.38       | 40.65|
| Eastern | 1,804| 10.76      | 51.41|
| Ashanti | 1,981| 1181.00    | 63.22|
| Brong Ahafo | 1,621| 9.66      | 72.88|
| Northern | 1,702| 10.15     | 83.03|
| upper East | 1,447| 8.63     | 91.66|
| Upper West | 1,399| 8.34     | 100.00|

Number of observations = 16,722
Source: Authors Own Construct (June, 2020)
### Table A3. Household poverty level and education (Logit Model with marginal effect)

| Variables                  | GLSS 7   | GLSS 6   | Pooled   |
|----------------------------|----------|----------|----------|
| Highest level of education | -0.033 (0.001)** | -0.032 (0.002)** | -0.030 (0.001)** |
| Details of education       |          |          |          |
| BECE                       | -0.618 (0.074)** | -0.150 (0.008)** | -0.872 (0.050)** |
| MSLC                       | 0.690 (0.065)** | -0.133 (0.006)** | -0.782 (0.041)** |
| SSS                        | -2.196 (0.169)** | -0.208 (0.010)** | -1.943 (0.096)** |
| Voc/Tech                   | -3.007 (0.261)** | -0.241 (0.012)** | -2.892 (0.171)** |
| Tertiary                   | -3.930 (0.502)** | -0.242 (0.010)** | -3.042 (0.185)** |
| Employment Status (1 = Employed) | -0.006 (0.006) | 0.028 (0.009)** | 0.013 (0.006)** |
| Sex (1 = Male)             | -0.009 (0.005)** | 0.011 (0.007)* | -0.003 (0.005) |
| Marital Status (1 = Married) | -0.004 (0.004) | -0.047 (0.008)** | -0.021 (0.005)** |
| Age                        | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Location (1 = Rural)       | 0.117 (0.004)** | 0.122 (0.005)** | 0.141 (0.004)** |
| Region                     | -0.008 (0.001)** | -0.003 (0.001)** | -0.005 (0.001)** |
| Household Size             | 0.011 (0.001)** | 0.031 (0.001)** | 0.024 (0.001)** |
| Number of Observations     | 14,009    | 16,722    | 30,781    |
| Prob>Chi2                  | 0.0000    | 0.0000    | 0.0000    |
| Pseudo R                   | 0.18      | 0.17      | 0.17      |

Note. The standard errors are within the parenthesis. *p < 0.1, **p < 0.05, ***p < 0.01
Source: Authors Own Construct (June, 2020)
Appendix A

Logit model

Calculation for Marginal and Average effect

OLS Marginal effect: $\frac{\partial \hat{p}}{\partial x_j} = \beta_j$ the index refers to the $j^{th}$ independent variable.

Marginal effect for probit model: $\frac{\partial \hat{p}}{\partial x_j} = \phi(X\beta)\beta_j$

| Table A4. Test for endogeneity |
|--------------------------------|
| Tests of endogeneity          |
| Ho: variables are exogenous   |
| Durbin (score) chi2(1)         | 15.8683 (p = 0.0001) |
| Wu-Hausman F(1,11708)         | 15.8763 (p = 0.0001) |

First-stage regression summary statistics

| Variable | Adjusted R-sq. | Partial R-sq. | Robust F(1,11708) | Prob > F |
|----------|----------------|---------------|--------------------|----------|
| edu      | 0.1714         | 0.1709        | 0.0047             | 52.174   | 0.0000   |

Minimum eigenvalue statistic = 55.6212

Critical Values

| 2SLS relative bias | 5% | 10% | 20% | 30% |
|--------------------|----|-----|-----|-----|
|                    | 10%| 15% | 20% | 25% |

2SLS Size of nominal 5% Wald test

| LIML Size of nominal 5% Wald test |
|-----------------------------------|
| 16.38                             |
| 8.96                              |
| 6.66                              |
| 5.53                              |

Marginal effect for logit model: $\frac{\partial \hat{p}}{\partial x_j} = \Lambda(X\beta)|1 - \Lambda(X\beta)|\beta_j = \frac{\phi'(x\beta)}{1+e^{x\beta}}\beta_j$

Average marginal effect: $\frac{\partial \hat{p}}{\partial x_j} = \frac{\sum \phi'(x\beta)\beta_j}{n}$
