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RESEARCH PAPER

Investigating the long-term effects of child labor on household poverty and food insecurity in Ghana

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Abstract

This paper explores the extent to which child labor perpetuates the cycle of household poverty, as well as food insecurity using the sixth round of the Ghana Living Standards Survey. The study employs a counterfactual framework and an endogenous treatment effect econometric technique to accurately examine the causal link between child labor and long-term household poverty and food security. Results suggest a positive relationship between early paid work and long-term poverty and food insecurity. This finding provides empirical evidence to indicate that child labor has the potential to create and perpetuate poverty traps. From a policy perspective, findings from this study also contribute to the modern policy debates surrounding the achievement of the sustainable development goals on reducing poverty and hunger in developing countries.

1. Introduction

Achieving the sustainable development goals of reducing poverty and ending hunger may be challenging to accomplish in the sub-Saharan Africa region if the current trends of child labor persist. According to the global estimates of child labor, one-fifth of all African children are involved in child labor [ILO (2017)]. This estimate, according to the report, is twice as high as any region in the world. Available data also suggest that over 70% of child laborers are found in the agricultural sector. There are some reasons why children may engage in the labor force at an early age. The different strands of literature highlight on resource constraints [Basu and Van (1998), Ray (2000), Abdullahi *et al.* (2016)], household structural characteristics [Edmonds (2006), Emerson and Souza (2008)], and anthropological factors [Delap (2001), Lieten (2003)] as the main reasons for child labor. The poverty

hypothesis narrative dominates the empirical literature which is supported by evidence from Canagarajah and Coulombe (1997), Blunch and Verner (2001), Ray (2003), Naeem *et al.* (2011). In the "poverty hypothesis," Hilson (2010) considers child labor as a consequence of household poverty and liquidity constraints which force parents to send their children to work rather than to school to develop their skills.

There is often a trade-off between short-run and long-run gains as children participate in the labor force. In the short-run, children may contribute to household income and hence increase the likelihood of survival of the household. However, in the long-run, through reduced human capital formation, the cycle of household poverty is perpetuated as poverty is passed on from one generation to the other. As a result of the reduced human capital formation, the current generation of child laborers may experience reduced future earnings. This further reduces their capacity to adequately provide the required resources to fully develop the human capital base of their children, leading to a cycle of intergenerational poverty. This situation may further threaten the sustenance of household food security as poverty restricts purchasing power to access sufficient food.

This study aims to explore the extent to which child labor perpetuates the cycle of household poverty as well as food insecurity. In particular, the study examines the causal relationship between child labor and long-term household poverty and food insecurity. Findings from the current study are particularly important because it provides empirical evidence for effective policy formulation around curtailing the prevalence of child labor in the context of sub-Saharan Africa, where the phenomenon is rife.

The remainder of the paper is structured as follows. The next section briefly provides a theoretical and empirical review of the literature on child labor, while sections 3 and 4 describe the data and the empirical strategy employed, respectively. Section 5 provides a discussion to the results, and section 6 concludes the paper with a summary of the findings and recommendations for policy.

1.1 Theoretical perspectives on why children work

Brown *et al.* (2002) theorize about child characteristics, community characteristics, and household characteristics that are likely to motivate children to participate in the labor force. The authors argue that the value of children's time is determined by the age, gender, and birth order of the child. Older children may be able to earn higher wages compared to younger siblings. Similarly, the demand for specific gender skills for particular job tasks on the market may influence parents' decision on which child to send to participate in the labor force. Moreover, community attributes play a critical role in the households' decision to push their children into the labor force. According to Brown *et al.* (2002), factors such as access to and quality of educational institutions are very critical in determining the returns to education. Schools in remote areas and poor quality schools are associated with lower returns to education given some particular level of investment. Such factors are, therefore, likely to induce households to withdraw their children from school and to the labor market.

Household characteristics such as household income can influence the time allocation of children between wage work and schooling according to the seminal work by Basu and Van (1998). Theories relating to the time allocation of children have been extensively discussed in the literature. There are, however, two strands on the theoretical literature that present contrasting views on the decision to participate in the labor force at an early age—the intra-household bargaining framework and

extra-household bargaining framework. In the intra-household bargaining framework, Bourguignon and Chiappori (1994) and Moehling (1995) posit that the decision for children to participate in the labor market is influenced by the bargaining power that the child wields which is also determined by the child's contribution to household resources. This bargaining power model is, however, complicated by the fact that the proportion of the household income earned is, in turn, determined by the decision about how much the child works in the first place.

In the extra-household bargaining framework which is based on Becker (1964), Edmonds (2007) considers the possibility that the decision to participate in the labour market is made by the parents on behalf of the child. Thus, the bargaining power of children in the household is naturally restricted. The framework suggests that parents optimise their utility function which consists of the welfare of the entire household as well as their children's future well-being. Parents then optimise the allocation of their children's activities, including schooling, leisure and paid work. This framework implies that the allocation between wage work, school and leisure is further influenced by household credit constraints and the net returns to education and leisure. Two-time reference points—current and future periods—have been considered in this framework. As argued by Baland and Robinson (2000), income-constrained parents use child labor as a device to transfer income from the future to the present to ensure the survival of the household. Brown *et al.* (2002) further explain that resource-poor households are associated with higher marginal utilities of current consumption relative to future consumption. As such, even if resource-poor households value their children's welfare the same as in resource-rich households, the probability of child labor will be higher in poor households.

This theoretical argument, therefore, suggests that households appear to focus more on present consumption relative to future consumption when confronted with the decision to put children to work or to school. To the extent that early labor market participation of children competes with schooling in the time allocation decision, the household's resources are a critical factor in parents' decision to put children to wage work because of parent's desire for household survival in the short-run.

1.2 Empirical review of child labor and its consequences

While empirical evidence on child labor and its implications is scarce in sub-Sahara Africa, Beegle *et al.* (2006) observe that available evidence examined correlations rather than causal relationships. Studies that have examined the effects of child labor have often focused more on relatively short-term effects such as educational outcomes as found in Akabayashi and Psacharopoulos (1999), Heady (2003), and Beegle *et al.* (2006). The literature on the long-term effects of child labor is even more limited. The few that exists also show inconsistent results. In rural Vietnam, Beegle *et al.* (2009) find an interesting mix of results as their study examines education and labor market outcomes of child labor. Their finding suggests a negative relationship between child labor and education outcomes but a positive effect on the standard of living proxied by an increased probability of working for wages. Using data from Brazil, Ilahi *et al.* (2005) suggest that working as a child may have a positive effect on adult earnings. Recent evidence from the United States by Chapman (2015) also confirms the positive effects of child labor on long-term earnings. These authors make the argument that participation in the labor force at an early age builds relevant work experience, which translates into increased wages in

the future. In sharp contrast, Emerson and Souza (2009) find a negative effect of child labor on adult earnings using survey data from Brazil.

Many studies in the child labor literature have focused on poverty as a critical determinant of child labor. However, another strand of literature also highlights the reverse relationship where child labor is the cause of household poverty. This suggests that early labor market exposure is likely to create and propagate some poverty trap. This strand of the literature studies child labor decisions for successive generations of the same family [Jafarey and Lahiri (2001)]. The authors claim that children who participate in the labor market are not able to acquire the required skills to ensure higher earnings in the future. Their reduced earning capacities at adulthood then increase their likelihood of sending their children to work creating a situation where another generation misses out on the human capital formation and its desired consequences, thereby creating a vicious poverty trap.

Using survey data from Brazil and an overlapping intergenerational model, Emerson and Souza (2003) provide evidence of the poverty trap as they find robust evidence that suggests intergenerational persistence of child labor. In the same study Emerson and Souza (2003) provide evidence to indicate that the likelihood of child labor is often determined by whether or not parents themselves participated in the labor market at an early age or not. They conclude that there appears to be an intergenerational effect of child labor. In a related study, Banerjee (2005) recognizes that household vulnerabilities may also lead to poverty traps. According to the study, vulnerabilities may induce households to reduce their investment in the human capital formation of their children which may perpetuate household poverty traps in the long-run.

The current study will add to the existing literature by examining the difficulty to assess long-term outcomes of child labor by employing a strategy that is robust and accounts for the problem of endogeneity in the household decision to put children to work in the context of a developing country in sub-Saharan Africa. Specifically, the study aims to examine the long-term effects of early labor market experiences on household poverty when these children become adults. In addition to exploring the long-term effect on poverty, the study also investigates the impact on household food insecurity. Findings from this study also contribute to the modern policy debates surrounding the achievement of the sustainable development goals on reducing poverty and hunger. Policy recommendations based on the findings of this study will provide policy options that could be considered to achieve the goals of reducing poverty and ending hunger.

2. Material and methods

The study makes use of the sixth round of the Ghana Living Standards Survey (GLSS, 6). The survey was carried out from October 2012 to September 2013. The GLSS is a nationally representative survey, which covers all ten regions of the country. The survey contains data on about 18,000 households in 1,200 enumeration areas. The enumeration areas were selected as primary sampling units, using a two-stage stratified sampling design. Fifteen households each were then systematically selected from each primary sampling unit. The data contain detailed information on households' demographic characteristics, education, health, employment and time use, migration and tourism, housing conditions, household agriculture, access to financial services asset ownership, household food security measures as well as the poverty status of households.

Each round of the survey is known to have a particular focus. For example, in the fifth round, the focus was on Non-Farm Enterprises. In the sixth round, the focus changed to Labor Force issues. Its concentration of the labor force makes the data from this round suitable for providing answers to the research questions proposed in this study as it contains the required variables for this research. Particularly, the labor force module of this round of the survey provides very detailed information on labor force issues including age at which individuals started working, wages and earnings, occupation types as well as other related labor market information.

The main variable of interest, child labor, is constructed as a dummy variable. The study considers different definitions of child labor based on the definition adopted by the Ghana Statistical Services (GSS) as well as other descriptions provided by the International Labour Organisations (ILO). Operationalization of the description of child labor is based on the age limits that children are allowed to engage in various types of labor market activities.[1] The variable is constructed using the information contained in the GLSS dataset, i.e., *at what age did you first start work?* The four variants of the variable constructed depict the variation in the level of work allowed by the ILO by age as well as the definition used by the GSS. The first variant is the definition adopted by the GSS, which defines child labor if an individual engaged in labor market activities when they were less than 12 years old. The other three definitions of child labor are based on ILO's age stipulation around appropriate ages for general employment (15 years), light work (13 years), and hazardous work (18 years). In each variant, child labor is constructed as a dummy variable taking on the value of 1 if the age at which the individual started work was less than 12 years, less than 15 years, less than 13 years, and less than 18 years, respectively, and 0 otherwise. The three other definitions described were considered to check for robustness of findings.

The two dependent variables related to the study objectives are poverty status and food insecurity. The poverty variable is calculated directly from the dataset, which is calculated by the GSS based on wealth quintiles of households which have been calculated based on household ownership of assets. In the data, households are put in three categories, namely very poor, poor, and non-poor. For this analysis, the poverty variable (povstatus) was recoded into a binary variable, taking a value of 1 if the household is classified as poor or very poor and 0 if the household was classified as non-poor in the dataset. Following Sen (1981), the second dependent variable, which is food insecurity, is constructed based on households' expenditure on food. The paper makes use of the mean household food share (as a percentage of total household spending). The mean household food share indicator has been recognised by the Food and Agricultural Organization as an important measure of food insecurity and has been included in the suite of indicators used as a measure of food insecurity According to Lele *et al.* (2016), this indicator can be used to assess the prevalence of food insecurity and to identify households that may be vulnerable to shocks that affect food prices.

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[1]The concept of child labor (by ILO standards) does not necessarily refer to simply any work done by a child, but, rather, to work that stunts or limits the child's development or puts the child at risk. However, in household survey data, it is difficult (perhaps impossible) to appropriately isolate the portion of time spent working on the farm that qualifies under this very nuanced definition [Beegle *et al.* (2007)]. Following studies such as De Janvry *et al.* (2006), Galiani and McEwan (2013), De Hoop and Rosati (2014), Ferreirra *et al.* (2017), and Tang *et al.* (2018, 2019), we use the definition of child labor based on age limitations provided by the ILO on various categories of labor market activities. In addition, in this paper, we make use of the definition used by the Ghana Statistical service which defines child labor as children (ages of 5–12 years) who are economically active.

According to Engels Law, when income increases, expenditure on food items rises. However, spending on other items increases, even more, indicating a decline in the share of total income spent on food. Smith and Subandoro (2007) categorize the levels of food insecurity based on the following: over 75% of household expenditure on food is considered to be very vulnerable and food insecure, whereas expenditure of 65–75% of household income on food indicates medium food insecurity. Those that spend less than 50% of their income on food are considered to have lower levels of food insecurity. Based on Smith *et al.*'s classification of food insecurity, a binary variable is constructed to capture the food insecurity status of individuals. The food insecurity variable takes on the value of 1 if the mean food share of the household is greater than 50% and the value of 0 if mean food share is less than 50%.

From Table 1, the statistics suggest that about 20% of the sample was put to wage work at an early age. About 63% of the sample is observed to be food insecure with the incidence of food insecurity substantial for people who reported being economically active when they were younger. A similar trend is observed for poverty status. Although 17.4% of the sample can be described as being poor, a higher proportion (29%) of people who experienced child labor are poor compared to about just a 15% of those who did not participate in the labor force at an early age. These significant differences of poverty status and food insecurity status by child labor (as shown in Table 2) may provide preliminary indications of the fact that child labor may play a critical role in perpetuating intergenerational poverty and food insecurity thereby engendering a poverty trap.

Concerning its distribution, Figure 1 suggests that the incidence of food insecurity is highest in four regions namely Central, Eastern, Northern, and Upper East regions while Greater Accra region recorded the lowest prevalence of food insecurity.

The study also controls for relevant characteristics at the individual, household, and regional levels. These specific controls include the age of the individual, household size, education level, gender, ethnicity, education and occupation of parents, and region and type of residence. The mean age in the sample is approximately 37 years, and half of the sample (50.4%) is male.

Regarding education level, only 16% of the sample had at least secondary education, with more than half (58%) of the sample with basic education. The largest ethnicity represented in the study sample is Akan (49%) followed by the northern ethnic group which represents about 28% of the study sample. The remainder of the sample is represented by Ewes (15%), Gas (7%), and other smaller ethnic groups who make up about 2% of the sample. About 52% of the sample resides in urban areas.

3. Theory and calculation

In establishing the causal effect of child labor on economic outcomes, studies such as Beegle *et al.* (2009) and Emerson and Souza (2003, 2006) have acknowledged and dealt with the endogeneity problem making use of both parametric and non-parametric techniques. In the current study, the paper aims to examine the effect of early labor market experiences on long-term outcomes such as poverty and food insecurity using non-experimental data. In estimating the causal effect of child labor on these outcomes, one cannot ignore the potential endogeneity that exists in the household's decision to put their children to wage work in the first place. Specific household characteristics such as household size, gender, and household income may influence the child labor decision. Ignoring such self-selection problems in the sample may lead to biased and inconsistent estimates.

Table 1. Descriptive statistics

Study variable	Full sample		No child labor		Child labor	
	Mean	SD	Mean	SD	Mean	SD
Child labor	0.201	0.4	0	0	1	0
Household food insecurity	0.625	0.48	0.586	0.49	0.781	0.41
Household poverty status	0.174	0.38	0.145	0.35	0.287	0.45
Household size	4.563	2.7	4.427	2.62	5.105	2.92
Age	36.575	12.78	36.614	12.72	36.417	13.03
Gender of respondent	0.504	0.5	0.499	0.5	0.525	0.5
Locality of residence	0.524	0.5	0.58	0.49	0.301	0.46
No education	0.01	0.1	0.01	0.1	0.009	0.09
Pre-basic education	0.172	0.38	0.148	0.35	0.267	0.44
Basic education	0.576	0.49	0.574	0.49	0.583	0.49
Secondary education	0.152	0.36	0.167	0.37	0.095	0.29
Post-secondary education	0.09	0.29	0.101	0.3	0.046	0.21
Akan ethnic group	0.489	0.5	0.515	0.5	0.383	0.49
Ga ethnic group	0.074	0.26	0.08	0.27	0.046	0.21
Ewe ethnic group	0.146	0.35	0.147	0.35	0.141	0.35
Northern ethnic group	0.275	0.45	0.238	0.43	0.42	0.49
Other ethnic group	0.017	0.13	0.019	0.14	0.01	0.1
Mother's education: no education	0.706	0.46	0.675	0.47	0.828	0.38
Mother's education: pre-basic	0.01	0.1	0.01	0.1	0.009	0.1
Mother's education: basic	0.25	0.43	0.276	0.45	0.148	0.35
Mother's education: secondary	0.018	0.13	0.021	0.14	0.007	0.08
Mother's education: post-secondary	0.016	0.13	0.018	0.13	0.008	0.09
Father's education: no education	0.523	0.5	0.489	0.5	0.66	0.47
Father's education: pre-basic	0.005	0.07	0.004	0.06	0.006	0.08
Father's education: basic	0.355	0.48	0.376	0.48	0.274	0.45
Father's education: secondary	0.054	0.23	0.06	0.24	0.028	0.17
Father's education: post-secondary	0.063	0.24	0.071	0.26	0.032	0.18

(Continued)

Table 1. (*Continued.*)

Study variable	Full sample		No child labor		Child labor	
	Mean	SD	Mean	SD	Mean	SD
Father's occupation: agriculture	0.608	0.49	0.569	0.5	0.767	0.42
Father's occupation: manufacturing	0.039	0.19	0.04	0.2	0.034	0.18
Father's occupation: wholesale/retail	0.062	0.24	0.07	0.26	0.027	0.16
Father's occupation: services	0.291	0.45	0.321	0.47	0.172	0.38
Mother's occupation: agriculture	0.545	0.5	0.496	0.5	0.741	0.44
Mother's occupation: manufacturing	0.011	0.11	0.012	0.11	0.008	0.09
Mother's occupation: wholesale/retail	0.368	0.48	0.405	0.49	0.217	0.41
Mother's occupation: services	0.076	0.26	0.086	0.28	0.034	0.18
Western region	0.119	0.32	0.119	0.32	0.122	0.33
Central region	0.093	0.29	0.11	0.31	0.024	0.15
Greater Accra region	0.149	0.36	0.176	0.38	0.041	0.2
Volta region	0.091	0.29	0.088	0.28	0.103	0.3
Eastern region	0.131	0.34	0.142	0.35	0.087	0.28
Ashanti region	0.132	0.34	0.136	0.34	0.118	0.32
Brong Ahafo region	0.102	0.3	0.08	0.27	0.188	0.39
Northern region	0.056	0.23	0.052	0.22	0.074	0.26
Upper East region	0.062	0.24	0.046	0.21	0.127	0.33
Upper West region	0.066	0.25	0.053	0.22	0.115	0.32
Observations	14,554		11,552		2,902	

Aside from the non-randomness in the child labor decision, there is also the possibility that some unobserved characteristics such as motivation and ability can influence both the probability of being put to work at an early age as well as future earnings which may have a direct influence on poverty status and whether or not one becomes food secure or insecure. If unobserved variables affect the treatment (probability of working at an early age) and the outcome (poverty status and food insecurity status), we are presented with a different kind of endogeneity problem which produces inaccurate estimates where conventional treatment effect estimators are used.

Table 2. Test of differences in poverty status and household food expenditure by child labor

Study variable	Test of differences in poverty status and food expenditure			
	Poverty status		Food expenditure	
	Difference	*t*-value	Difference	*t*-value
Household food expenditure	–	–	−0.195***	(−19.70)
Household poverty status	−0.142***	(−18.28)	–	–
Household size	−0.678***	(−12.15)	−0.678***	(−12.15)
Age	0.198	(0.74)	0.198	(0.74)
Gender of respondent	−0.0261*	(−2.52)	−0.0261*	(−2.52)
Locality of residence	0.279***	(27.59)	0.279***	(27.59)
No education	0.00134	(0.65)	0.00134	(0.65)
Pre-basic education	−0.119***	(−15.34)	−0.119***	(−15.34)
Basic education	−0.00834	(−0.81)	−0.00834	(−0.81)
Secondary education	0.0713***	(9.58)	0.0713***	(9.58)
Post-secondary education	0.0549***	(9.28)	0.0549***	(9.28)
Akan ethnic group	0.132***	(12.77)	0.132***	(12.77)
Ga ethnic group	0.0342***	(6.33)	0.0342***	(6.33)
Ewe ethnic group	0.00683	(0.93)	0.00683	(0.93)
Northern ethnic group	−0.182***	(−19.93)	−0.182***	(−19.93)
Other ethnic group	0.00940***	(3.49)	0.00940***	(3.49)
Mother's education: no education	−0.154***	(−16.38)	−0.154***	(−16.38)
Mother's education: pre-basic	0.000738	(0.36)	0.000738	(0.36)
Mother's education: basic	0.128***	(14.36)	0.128***	(14.36)
Mother's education: secondary	0.0142***	(5.12)	0.0142***	(5.12)
Mother's education: post-secondary	0.0104***	(4.01)	0.0104***	(4.01)
Father's education: no education	−0.170***	(−16.59)	−0.170***	(−16.59)
Father's education: pre-basic	−0.00196	(−1.39)	−0.00196	(−1.39)
Father's education: basic	0.102***	(10.31)	0.102***	(10.31)
Father's education: secondary	0.0320***	(6.84)	0.0320***	(6.84)
Father's education: post-secondary	0.0383***	(7.61)	0.0383***	(7.61)
Father's occupation: agriculture	−0.198***	(−19.80)	−0.198***	(−19.80)
Father's occupation: manufacturing	0.0064	(1.59)	0.0064	(1.59)
Father's occupation: wholesale/retail	0.0431***	(8.65)	0.0431***	(8.65)
Father's occupation: services)	0.149***	(15.88)	0.149***	(15.88)
Mother's occupation: agriculture	−0.244***	(−24.10)	−0.244***	(−24.10)

(*Continued*)

Table 2. (*Continued.*)

Study variable	Test of differences in poverty status and food expenditure			
	Poverty status		Food expenditure	
	Difference	*t*-value	Difference	*t*-value
Mother's occupation: manufacturing	0.00402	(1.82)	0.00402	(1.82)
Mother's occupation: wholesale/ retail	0.189***	(19.09)	0.189***	(19.09)
Mother's occupation: services	0.0516***	(9.42)	0.0516***	(9.42)
Western region	−0.00356	(−0.53)	−0.00356	(−0.53)
Central region	0.0858***	(14.35)	0.0858***	(14.35)
Greater Accra region	0.135***	(18.41)	0.135***	(18.41)
Volta region	−0.0150*	(−2.52)	−0.0150*	(−2.52)
Eastern region	0.0547***	(7.83)	0.0547***	(7.83)
Ashanti region	0.0175*	(2.49)	0.0175*	(2.49)
Brong Ahafo region	−0.108***	(−17.38)	−0.108***	(−17.38)
Northern region	−0.0228***	(−4.76)	−0.0228***	(−4.76)
Upper East region	−0.0813***	(−16.40)	−0.0813***	(−16.40)
Upper West region	−0.0621***	(−12.13)	−0.0621***	(−12.13)
Observations	14,454		14,454	

t-statistics in parenthesis *p < 0.05, **p < 0.01, ***p < 0.001.
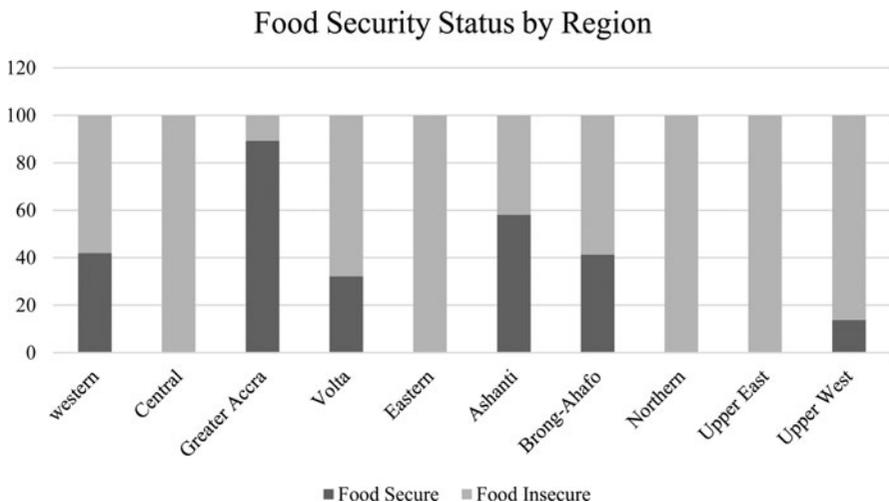
Figure 1. The prevalence of food insecurity by region.

In resolving the two endogeneity problems, the study employs matching techniques that make use of a counterfactual framework—to deal with the problem of self-selection based on observed characteristics and endogenous treatment estimators to deal with the issue of unobserved variables that affect both the treatment and the outcome.

To resolve the first endogeneity problem of self-selection, we adopt the inverse probability of treatment weights with regression adjustment (IPWRA), a matching estimator first developed by Robins (1986). The IPWRA uses propensity scores to form weights which are used to create a "pseudo comparison" group. We consider those that had early labor market experiences to be in the "treatment" group while those that were not put to wage work are assumed to be assigned to a "comparison" group. The propensity score is a conditional probability of being assigned to the treatment group based on a set of observed characteristics. This is formally expressed as $e(x) = \Pr(T_t = 1 | X_i)$ where T_t is a binary treatment indicator and X is a vector of observed characteristics.

The weights are constructed by estimating each person's probability of being either in the "treatment" group or the "comparison" group based on observed covariates and then weighted by the inverse of this estimated probability [Thoemmes and Ong (2016)]. This implies that individuals are assigned to the "treatment" group with a weight of $1/\Pr(T_t = 1 | X_i)$ and individuals are assigned to the "comparison" group with a weight of $1/(1 - \Pr(T_t = 1 | X_i))$. Once the inverse probability weights are obtained, treatment effects are calculated by incorporating the weights in a regression model. In this study, we estimate the causal effect of child labor by using the IPWRA, which is used to estimate corrected regression coefficients that are subsequently used to perform regression adjustment. This allows us to model both the "treatment" model and the outcome model to account for the non-random treatment assignment (Cattaneo, 2010).

Assuming $Y_i(1)$ is the poverty status (food insecurity status) of individual i who participated in the labor force at an early age (i.e., belongs to the treatment group) and $Y_i(0)$ presents the poverty status (food insecurity status) for an individual who was not put to wage work at an early age, the treatment effect of early labor market participation represented by TREAT for an individual is expressed as

$$\text{Treat}_i = Y_i(1) - Y_i(0). \tag{1}$$

In this study, we are interested in the average effect of the treatment for those who received the treatment, i.e., ATET. The ATET estimates the poverty status (food insecurity status) of those who were put to wage work at an early age. The treatment effect is represented by the equation as:

$$\text{ATET} = E(\text{Treat}|T_t = 1) = E(Y(1)|T_t = 1) - E(Y(0)|T_t = 1). \tag{2}$$

To resolve the second source of endogeneity problem where both the outcome and treatment may be influenced by unobserved characteristics, the study estimates the endogenous treatment effect model. The endogenous treatment estimator relaxes the independence assumption, which suggests that no unobserved characteristics affect both treatment assignment and the outcome variable. This was first proposed by Hausman (1978) and further developed by Wooldridge (2002) and Terza *et al.* (2008a, 2008b). The endogenous treatment model has been widely used in recent times in applied economics particularly in health economics and labor economics by

Stuart *et al.* (2009), Gibson *et al.* (2010), Fang *et al.* (2011), Baughman and Smith (2012), and Grabowski *et al.* (2013).

Like the instrumental variable (IV) approach, the endogenous treatment model (also described as two-stage residual inclusion—2SRI) accounts for both observed and unobserved cofounders by estimating a two-stage approach where the first stage involves the estimation of the probability of receiving the treatment conditioned on observed characteristics as cofounders. The logit or probit estimators are used to obtain the residuals. In the second stage, however, conventional instrumental variable— 2SLS and the endogenous treatment models differ. While IV estimators include the treatment variable and the predicted values of the observed cofounders only in the second stage, 2SRI includes the original treatment indicator, the observed characteristics and the residuals obtained from the first stage as an added covariate [Basu and Coe (2015)]. Although the traditional 2SLS and 2SRI have been noted to produce identical results in some instances [Basu and Coe (2015)], the 2SRI is deemed to be more appropriate in the cases where the endogenous treatment variable and the outcome variable are both dichotomous [Blundell and Powell (2004a, 2004b), Terza *et al.* (2008a, 2008b)] as in this study where both poverty and food insecurity status are both binary outcomes.

In this study, the first stage is represented by the probit model below:

$$\text{Child labour} = \alpha_0 + \alpha_1 X + \varepsilon. \tag{3}$$

Where child labour is a binary variable which takes the value of 1 if the individual was put to wage work at an early age and 0 otherwise. X represents the observed characteristics such as gender, parent's education and occupation, location among others that are likely to influence the decision to put children to work or not. The ε represents the error term which captures other unobserved characteristics such as motivation and ability, which are likely to influence the decision of early labor market exposure.

The second stage is presented by the models below (to reflect the two outcomes of interest):

$$\text{Pov Status} = \beta_0 + \beta_1 \text{Child Labour} + \beta_2 \hat{\varepsilon} + \beta_3 X + \mu, \tag{4}$$

$$\text{Fd Insecure} = \beta_0 + \beta_1 \text{Child Labour} + \beta_2 \hat{\varepsilon} + \beta_3 X + \mu. \tag{5}$$

As indicated in Basu and Coe (2015), the residuals obtained from the first stage are included as an additional regressor in the second stage in addition to other covariates which minimizes the bias. From equations (4) and (5) above, *PovStatus* is a binary variable which takes on the value of 1 if the individual is poor and 0 otherwise, *Fdinsecure* measures the food insecurity status of the individual and $\hat{\varepsilon}$ represents the residual obtained from equation (3). X is the observed covariate that is likely to affect poverty and μ represents the error term in the second stage. This model, therefore, accurately estimates the causal effect of child labor on poverty status.

4. Results and discussion

Tables 3 and 4 present the estimation results for the first and second research objectives, respectively. From Table 3, after accounting for self-selection (using the matching estimator), the results suggest a positive relationship between early labor market

Table 3. Estimation results from matching technique

	Model 1: poverty status		Model 2: household food insecurity	
	ATE	ATET	ATE	ATET
Minimum age for engaging in work is 12 years (Ghana Statistical Service Definition)				
Child labor	0.020	0.020	0.015	0.010
(All types of work)	(2.11)**	(2.12)**	(3.20)***	(3.28)***
Minimum age for engaging in general employment is 15 years (according to ILO)				
Child labor	0.009	0.015	0.021	0.015
(General employment)	(1.51)	(1.88)*	(5.95)***	(5.48)***
Minimum age for engaging in light work is 13 years (according to ILO)				
Child labor	0.009	0.014	0.019	0.013
(Light work)	(1.38)	(1.67)*	(5.00)***	(4.72)***
Minimum age for engaging in hazardous work of 18 years (according to ILO)				
Child labor	0.011	0.014	0.015	0.012
(Hazardous work)	(1.85)*	(1.80)*	(4.79)***	(4.28)***

* means significance at 10%, ** means significance at 5% and *** means significance at 1%.

exposure and poverty status and food insecurity. Specifically, participation in the labor force at an early age significantly raises an individual's likelihood of being poor in the future by about 2%. The results are consistent across the different measures of child labor although the level of significance reduces when other ILO measures of child labor are considered. The results also show that early labor market participation increases the probability of future food insecurity by approximately 1–2% on average. Similarly, the effects appear to be consistent across the different variation of the definitions of child labor considered. This consistency in results suggests that the impact of child labor on food insecurity is robust to changes in the definition of child labor used.

These results support arguments by Emerson and Souza (2009), Barnejee (2005), and Hilson (2010) which suggest that putting children to work creates hindrances for human capital development which in turn reduces the market value of their skills when these children become adults. If children are deprived of the opportunity to develop their human capital, they are likely to remain poor. Comparatively, children who have not had the opportunity to develop their skills fully become more vulnerable to economic shocks and also end up in less lucrative occupations thereby perpetuating their household poverty that forced them into wage work at an early stage in the first place. The findings suggest that although putting children to work may be used to ensure household survival in the short-run as argued by Baland and Robinson (2000), the long-run effects of this decision by households threaten the economic survival of the household in the future. The net result, therefore, is increased vulnerabilities which may have dire consequences on food security and other dimensions of household welfare.

Results from the endogenous treatment model, which accounts for endogeneity in the decision to participate in wage work at an early age, present even more robust

Table 4. Endogenous treatment effect estimation results

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	t-Stats	Coefficient	t-Stats
First stage: dependent variable—child labor				
Household size	0.0193***	(4.14)	0.0167***	−3.91
Gender of respondent	0.0313	(1.22)	0.0456*	−1.97
Ga ethnic group	0.153*	(2.54)	−0.00838	(−0.19)
Ewe ethnic group	0.175***	(3.37)	0.0902*	−2.41
Northern ethnic group	0.066	(1.5)	0.058	−1.8
Other ethnic group	−0.221	(−1.91)	0.000931	−0.01
Locality of residence	−0.403***	(−13.90)	−0.720***	(−26.23)
Mother's education: pre-basic	−0.0563	(−0.43)	−0.0341	(−0.27)
Mother's education: basic	−0.119**	(−3.10)	−0.119**	(−3.16)
Mother's education: secondary	−0.167	(−1.30)	−0.255*	(−2.00)
Mother's education: post-secondary	0.143	(1.04)	0.0705	−0.52
Father's education: pre-basic	0.165	(0.93)	0.127	−0.74
Father's education: basic	0.0291	(0.83)	0.0139	−0.41
Father's education: secondary	−0.0428	(−0.58)	−0.0754	(−1.04)
Father's education: post-secondary	−0.039	(−0.53)	−0.102	(−1.40)
Mother's occupation: manufacturing	0.147*	(2.11)	−0.214*	(−2.26)
Mother's occupation: wholesale/retail	−0.320***	(−4.65)	−0.157***	(−6.34)

Mother's occupation: services	−0.0843*	(−2.16)	−0.287***	(−5.63)
Father's occupation: manufacturing	−0.336*	(−2.57)	0.00796	(0.15)
Father's occupation: wholesale/retail	−0.225***	(−6.60)	−0.185***	(−3.69)
Father's occupation: services	−0.411***	(−6.01)	−0.0126	(−0.44)
Western region	0.494***	(7.94)	0.0266	(0.5)
Central region	−0.310***	(−3.96)	−1.239***	(−19.36)
Volta region	0.432***	(6.29)	−0.00688	(−0.12)
Eastern region	0.185**	(3.03)	−0.757***	(−14.27)
Ashanti region	0.503***	(8.11)	0.159**	(3.07)
Brong Ahafo region	0.960***	(15.41)	0.416***	(7.76)
Northern region	0.660***	(8.6)	−0.342***	(−5.07)
Upper East region	0.982***	(13.11)	0.166*	(2.54)
Upper West region	0.761***	(10.16)	0.166**	(2.61)
Second stage: poverty status/food insecurity status				
Child labor	0.0869***	(4.52)	0.375***	(56.09)
Household size	0.0283***	(26.07)	−0.00177*	(−2.13)
Age	−0.00368**	(−2.85)	0.000046	(0.06)
Square of age	0.0000435**	−2.65	−0.0000002	(−0.02)
Gender of respondent	0.0130*	(2.26)	−0.0011	(−0.25)
Locality of residence	−0.129***	(−19.11)	−0.563***	(−115.1)
Pre-basic education	0.0486	(1.67)	−0.0194	(−1.06)
Basic education	−0.0278	(−0.98)	−0.0124	(−0.69)

(Continued)

Table 4. (*Continued.*)

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
Secondary education	−0.0933**	(−3.20)	−0.0215	(−1.16)
Post-secondary education	−0.121***	(−4.05)	−0.0358	(−1.89)
Western region	−0.0145	(−1.27)	0.147***	(16.82
Central region	−0.00409	(−0.34)	0.670***	(71.74)
Volta region	0.0458***	(3.68)	0.167***	(17.51)
Eastern region	0.00311	(0.28)	0.623***	(73.07)
Ashanti region	−0.0428***	(−3.93)	0.0686***	(8.22)
Brong Ahafo region	0.0101	(0.79)	0.0669***	(7.24)
Northern region	0.137***	(9.41)	0.592***	(53.51)
Upper East region	0.0874***	(5.85)	0.422***	(38.42)
Upper West region	0.262***	(18.14)	0.165***	(15.28)
athrho	−0.095229	−3.1	−1.140	−50.73
lnsigma	−1.085353	−180.12	−1.343	−175.40
rho	−0.094942		−0.814	
lambda	−0.03207		−0.212	
sigma	0.337783		−0.261	
Observations	14,454		14,454	

t-statistics in parenthesis *p < 0.05, **p < 0.01, ***p < 0.001.

evidence on the adverse effects of child labor on long-term poverty and food insecurity. The estimates suggest that early labor market experiences significantly increase the likelihood of poverty in the future by about 9% while it raises the probability of food insecurity by about 38%. Using other definitions of child labor for robustness checks, Tables A.1–A.3 show consistent results. It is worth noting that the impact on poverty is highest when the age limit for hazardous labor is considered as a measure of child labor. The effect on the probability of poverty increases to about 18%. Other significant determinants of poverty status and food insecurity from the study include education, household size, locality of residence as well as region of residence.

Secondary and post-secondary education reduces the likelihood of being impoverished by 9% and 12%, respectively, compared to people who have no education. Also, residents in the urban areas are about 13% less likely to be poor and 56% less likely to be food insecure relative to people who live in rural areas.

Results from the first stage, which estimates the determinants of child labor, confirm that household characteristics such as the household size, ethnicity parent's education as well as locational characteristics such as type of residence and region of residence significantly influence the decision to participate in the labor market at an early age. Mother's education appears to reduce the tendency of child labour significantly. As argued by Mukherjee and Das (2008), this further supports other arguments in the literature on the importance of women's empowerment in improving children's welfare.

The study results also indicate the importance of parent's occupation in influencing the propensity to put children to wage work. Children whose fathers are in the services, manufacturing, and wholesale and retail sectors are, respectively, 41%, 34%, and 22% less likely to be put to wage work compared to the children whose parents work in the agricultural sector. This finding is similar to the evidence provided by Anokhi and Sadoulet (2005) who also established that parents in the agricultural sector are more likely to put their children to work compared to other sectors. The significant role of occupation in the child labor decision confirms the "poverty hypothesis" put forward by Hilson (2010). All things being equal, relative to the other sectors (wholesale and retail, services, manufacturing) parents who work in the agricultural sector are more likely to be vulnerable to shocks due to crop failure among other factors in Ghana and as such have less income. Households may put their children to wage work to mitigate against the possible effects of such shocks on family income as argued by Galli (2001).

Closely related to the issue of poverty is residence type. Results from the estimations indicate an increased probability of early labor market participation in rural areas than in the urban areas. Children in the urban areas are about 41% less likely to engage in paid work relative to children in the rural setting. In addition to poverty, Brown *et al.* (2002), Odonkor (2008), and Feigeben (2010) argue that the low quality of education coupled with difficulties in obtaining jobs after graduation may explain such differences. Difficulties in accessing educational facilities in most rural areas have been noted by the authors to discourage parents from investing in the human capital development of their children and instead choose for their children to assist in household farms and other economic activities such as fishing, animal rearing, and mining.

It is critical to acknowledge the limitations associated with the findings discussed above and its implication for interpreting the study results. Although these findings are robust, such results should be interpreted with caution due to the difficulty in operationalizing the definition of child labor. Although ILO emphasizes on work that deprives children of their childhood, potential, and dignity and work that is harmful to the physical and mental development of children in the definition of child labor, the data used in the analysis

do allow us to capture these dimensions of child labor explicitly. In the absence of this, the results may not capture these critical aspects of child labor directly.

5. Conclusion and recommendations

The literature has provided extensive discussions on poverty as a cause of child labor. However, such studies have mostly focused more on the unidirectional relationship between poverty and child labor with relatively little empirical evidence on how child labor also affects poverty in the long-term. In this study, we examined this relationship by using the sixth round of the GLSS and employed robust econometric techniques which accounted for different kinds of endogeneity problems to answer two research questions.

The study examines the child labour–poverty trap nexus by considering two long-term outcomes, poverty and food insecurity status. The first research objective is to investigate the long-term effect of child labor on poverty status and the second research objective is to examine the long-term effect of child labor on household food insecurity status when such children have now become adults.

Results from the analysis indicate that engaging in early paid work increases the likelihood of long-term poverty and food insecurity. This finding provides empirical evidence to confirm that child labor has the potential to create and perpetuate a poverty trap. These results are robust as the study employs both a counterfactual framework and endogenous treatment estimation techniques to deal with problems associated with self-selection and endogenous treatments, respectively. Also, the study makes use of other definitions of child labor based on ILO's categorization of child labor activities. Aside from child labor, the study shows that other characteristics such as education, household size, and type of residence are also important determinants of poverty and food insecurity. Moreover, the results also show regional differences in the propensity to be poor and food insecure. Characteristics such as parent's education, parent's occupation, ethnicity, household size, type and region of residence are critical in influencing households' decisions to put their children to paid work.

From a policy perspective, findings from this study will be useful not only for Ghana but other developing economies who are striving to achieve the sustainable development goals of reducing poverty in all forms and ending hunger by 2030. Results from this study provide some policy options for consideration by governments. The robust effect of child labor on poverty and food insecurity is particularly relevant for policies and strategies to reduce the phenomenon of child labor in Ghana. Given that findings from this study suggest poverty as a cause of child labor (based on results regarding parental education, occupation, and household size), governments may consider the use of social protection programmes to reduce household liquidity constraints that may force parents to push their children into the labor force for wage work. Also, policies to eliminate the vulnerabilities associated with the agricultural sector in the country may be considered since results suggest that parents in the agricultural sector are more likely to put their children to work. Such a policy would provide some level of security for households which would go a long way to reduce households' reliance on supplementary income from their children's wage work. Another policy recommendation is to continue efforts in educating parents on the importance of educating their children to ensure adequate human capital development which will reduce the likelihood of poverty in the future. There is also the need to implement

more targeted poverty reduction strategies, particularly focusing on the rural areas (where child labor is widespread) to improve on the local economies to reduce the incidence of child labour in these areas.

In interpreting the results in this study for policy, it is important to recognise the limitations of the data used concerning the measurement of child labor. It is almost impossible to accurately separate work that is harmful to the development of the child from other types of household chores using household survey data such as the GLSS. Therefore, the results obtained in this study may reflect averages across all scenarios, including work that is exploitative and work that helps in building knowledge. Although this study makes use of the definition used by the GSS and other broader definitions provided by the ILO, future research on child labor could benefit from a child labor survey that makes use of more precise measures of the concept which considers the nuances in its definition.

Conflict of interest

None.

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Appendix A

Table A.1. Minimum age of 15 years for employment—Childlab3

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
First stage: dependent variable—child labor				
Household size	0.0193***	(4.66)	0.0179***	(4.56)
Gender of respondent	0.010	(0.44)	0.016	(0.76)

(*Continued*)

Table A.1. (*Continued.*)

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
Ga ethnic group	0.220***	(4.54)	0.0248	(0.68)
Ewe ethnic group	0.250***	(5.67)	0.107***	(3.34)
Northern ethnic group	0.1.62***	(4.21)	0.095***	(3.37)
Other ethnic group	−0.141	(−1.49)	−0.058	(−0.82)
Locality of residence: urban	−0.493***	(−19.57)	−0.688***	(−28.27)
Mother's education: pre-basic	0.043	(0.39)	0.052	(0.66)
Mother's education: basic	−0.075**	(−2.33)	−0.0383	(−1.62)
Mother's education: secondary	−0.256**	(−2.38)	−0.100	(−1.31)
Mother's education: post-secondary	−0.156	(−1.28)	−0.008	(−0.09)
Father's education: pre-basic	0.374**	(2.42)	0.0801	(0.72)
Father's education: basic	0.048	(1.57)	−0.014	(−0.61)
Father's education: secondary	−0.009	(−0.14)	−0.019	(−0.42)
Father's education: post-secondary	0.020	(0.33)	−0.059	(−1.30)
Mother's occupation: manufacturing	0.201*	(1.90)	0.010	(0.23)
Mother's occupation: wholesale/retail	−0.221***	(−7.56)	−0.075	(−1.90)
Mother's occupation: services	−0.309***	(−5.61)	−0.008	(−0.33)
Father's occupation: manufacturing	0.144**	(2.41)	−0.106	(−1.38)
Father's occupation: wholesale/retail	−0.213***	(−3.89)	−0.147***	(−6.88)
Father's occupation: services	−0.097**	(−2.93)	−0.173***	(−4.30)
Western region	0.458***	(8.99)	0.108**	(2.36)
Central region	−0.351***	(−5.68)	−1.080***	(−20.01)
Volta region	0.279***	(4.88)	0.013	(0.26)
Eastern region	0.218**	(4.47)	−0.427***	(−9.56)
Ashanti region	0.554***	(11.06)	0.258***	(5.91)
Brong Ahafo region	0.828***	(15.98)	0.423***	(9.12)
Northern region	0.560***	(9.18)	0.078	(1.32)
Upper East region	0.773***	(11.98)	0.314***	(5.39)
Upper West region	0.458***	(7.08)	0.074	(1.31)
Second stage: poverty status/food insecurity status				
Child labor	0.085***	(4.12)	0.390***	(49.75)
Household size	0.029***	(27.28)	−0.003**	(−3.07)

(*Continued*)

Table A.1. (*Continued.*)

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
Age	−0.004**	(−3.21)	−0.0003	(−0.43)
Square of age	0.00005**	(2.96)	0.0001	(0.5)
Gender of respondent	0.015**	(2.76)	−0.001	(−0.32)
Locality of residence	−0.124***	(−16.89)	−0.543***	(−106.34)
Pre-basic education	0.047*	(1.64)	−0.028	(−1.50)
Basic education	−0.025	(−0.90)	−0.017	(−0.97)
Secondary education	−0.090**	(−3.12)	−0.023	(−1.22)
Post-secondary education	−0.118***	(−4.00)	−0.042*	(−2.24)
Western region	−0.014	(−1.27)	0.127***	(14.14)
Central region	−0.002	(−0.18)	0.677***	(69.8)
Volta region	0.039**	(3.22)	0.156***	(16.04)
Eastern region	0.004	(0.40)	0.595***	(67.93)
Ashanti region	0.048***	(−4.36)	0.051***	(5.91)
Brong Ahafo region	0.013	(1.00)	0.053***	(5.63)
Northern region	0.129***	(8.86)	0.561***	(49.45)
Upper East region	0.090***	(6.10)	0.405***	(36.06)
Upper West region	0.266***	(18.85)	0.171***	(15.43)
athrho	−0.1188737	−3.35	−1.140	−42.60
lnsigma	−1.076248	−176.54	−1.290	−141.44
rho	−0.1183169		−0.814	
lambda	−0.0403309		−0.224	
sigma	0.3408721		−0.275	
Observations	15,554		15,554	

* means significance at 10%, ** means significance at 5% and *** means significance at 1%.

Table A.2. Minimum age of 13 years for light work—Childlab4

| | Model 1 | | Model 2 | |
| | Poverty status | | Food insecurity status | |
	Coefficient	t-Stats	Coefficient	t-Stats
First stage: dependent variable—child labor				
Household size	0.016***	(3.69)	0.014***	(3.47)
Gender of respondent	0.018	(0.78)	0.029	(1.36)
Ga ethnic group	0.220***	(4.19)	0.011	(0.28)
Ewe ethnic group	0.204***	(4.41)	0.086*	(2.57)
Northern ethnic group	0.061	(1.53)	0.053*	(1.82)
Other ethnic group	−0.238*	(−2.32)	−0.097	(−1.28)
Locality of residence: urban	−0.426***	(−16.28)	−0.676***	(−27.02)
Mother's education: pre-basic	−0.050	(−0.43)	0.0346	(0.42)
Mother's education: basic	−0.109**	(−3.20)	−0.036	(−1.44)
Mother's education: secondary	−0.231*	(−2.00)	−0.103	(−1.23)
Mother's education: post-secondary	−0.119	(−0.92)	0.022	(0.24)
Father's education: pre-basic	0.201	(1.26)	−0.025	(−0.21)
Father's education: basic	0.015	(0.47)	−0.035	(−1.50)
Father's education: secondary	−0.045	(−0.69)	−0.029	(−0.62)
Father's education: post-secondary	−0.049	(−0.74)	−0.062	(−1.31)
Mother's occupation: manufacturing	0.133*	(2.11)	0.0162	(0.35)
Mother's occupation: wholesale/retail	−0.228***	(−3.88)	−0.099**	(−2.36)
Mother's occupation: services	−0.078*	(−2.22)	−0.014	(−0.54)
Father's occupation: manufacturing	−0.149	(−1.36)	−0.079	(−1.00)
Father's occupation: wholesale/retail	−0.208***	(−6.77)	−0.146***	(−6.56)
Father's occupation: services	−0.290***	(−4.95)	−0.189***	(−4.40)
Western region	0.490***	(8.86)	0.068	(1.4)
Central region	−0.259***	(−3.83)	−1.091***	(−19.15)
Volta region	0.416***	(6.8)	0.043	(0.82)
Eastern region	0.236***	(4.42)	−0.573***	(−12.05)
Ashanti region	0.585***	(10.73)	0.230***	(4.96)
Brong Ahafo region	0.967***	(17.41)	0.465***	(9.57)
Northern region	0.653***	(9.43)	−0.142*	(−2.29)
Upper East region	0.920***	(13.52)	0.251***	(4.17)
Upper West region	0.682***	(9.97)	0.156**	(2.64)

(*Continued*)

Table A.2. (*Continued.*)

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
Second stage: poverty/food insecurity status				
Child labor	0.079***	(4.00)	0.382***	(55.32)
Household size	0.029***	(27.62)	−0.0029**	(−2.30)
Age	−0.004**	(−3.23)	−0.000	(−0.21)
Square of age	0.000**	(2.96)	0.000	(0.23)
Gender of respondent	0.0155**	(2.77)	−0.002	(−0.41)
Locality of residence	−0.128***	(−18.81)	−0.560***	(−114.81)
Pre-basic education	0.047*	(1.65)	−0.026	(−1.44)
Basic education	−0.025	(−0.91)	−0.017	(−0.94)
Secondary education	−0.0903**	(−3.14)	−0.024	(−1.29)
Post-secondary education	−0.118***	(−4.02)	−0.043**	(−2.28)
Western region	−0.012	(−1.10)	0.134***	(15.31)
Central region	−0.005	(−0.45)	0.664***	(70.18)
Volta region	0.040**	(3.23)	0.155***	(16.23)
Eastern region	0.005	(0.5)	0.599***	(69.97)
Ashanti region	−0.045***	(−4.19)	0.059***	(7.06)
Brong Ahafo region	0.014	(1.07)	0.052***	(5.59)
Northern region	0.133***	(9.27)	0.575***	(52.13)
Upper East region	0.092***	(6.3)	0.409***	(37.4)
Upper West region	0.265***	(18.68)	0.163***	(15.01)
athrho	−0.1188737	−3.10	−1.137648	−49.03
lnsigma	−1.076248	−182.43	−1.313004	−162.11
rho	−0.1009986		−0.8136205	
lambda	−0.034386		−0.2188725	
sigma	0.3404599		0.2690106	
Observations	15,554		15,554	

Table A.3. Minimum age of 18 years for hazardous work—Childlab5

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
First stage: dependent variable—child labor				
Household size	0.014***	(3.51)	0.014***	(3.66)
Gender of respondent	0.022	(1.04)	0.024	(1.19)
Ga ethnic group	0.238***	(5.37)	0.072*	(1.98)
Ewe ethnic group	0.261***	(6.50)	0.157***	(4.76)
Northern ethnic group	0.228***	(6.28)	0.159***	(5.39)
Other ethnic group	0.077	(0.95)	0.098	(1.45)
Locality of residence: urban	−0.443***	(−18.50)	−0.544***	(−23.51)
Mother's education: pre-basic	0.102	(0.97)	0.081	(0.95)
Mother's education: basic	−0.048	(−1.66)	−0.032	(−1.35)
Mother's education: secondary	−0.267**	(−2.93)	−0.170*	(−2.30)
Mother's education: post-secondary	−0.275**	(−2.59)	−0.144	(−1.75)
Father's education: pre-basic	0.195	(1.26)	0.076	(0.63)
Father's education: basic	−0.053	(−1.90)	−0.051*	(−2.27)
Father's education: secondary	−0.141**	(−2.59)	−0.089**	(−2.01)
Father's education: post-secondary	−0.095	(−1.74)	−0.110**	(−2.50)
Mother's occupation: manufacturing	0.102	(1.82)	0.007	(0.16)
Mother's occupation: wholesale/retail	−0.162***	(−3.41)	−0.066	(−1.76)
Mother's occupation: services	−0.084**	(−2.78)	−0.001	(−0.04)
Father's occupation: manufacturing	−0.206*	(−2.14)	−0.075	(−0.98)
Father's occupation: wholesale/retail	−0.227***	(−8.48)	−0.162***	(−7.36)
Father's occupation: services	−0.313***	(−6.45)	−0.186***	(−4.67)
Western region	0.349***	(7.70)	0.193***	(4.44)
Central region	−0.271***	(−5.35)	−0.643***	(−13.02)
Volta region	0.182***	(3.52)	0.074	(1.55)
Eastern region	0.137**	(3.21)	−0.088**	(−2.06)
Ashanti region	0.441***	(10.01)	0.294***	(7.1)
Brong Ahafo region	0.759***	(15.87)	0.538***	(11.8)
Northern region	0.490***	(8.05)	0.510***	(8.73)
Upper East region	0.498***	(8.19)	0.452***	(7.78)
Upper West region	0.102	(1.71)	−0.027	(−0.50)

(*Continued*)

Table A.3. (*Continued.*)

	Model 1		Model 2	
	Poverty status		Food insecurity status	
	Coefficient	*t*-Stats	Coefficient	*t*-Stats
Second stage: poverty/food insecurity status				
Child labor	0.175***	−6.54	0.355***	−22.28
Household size	0.029***	−26.22	−0.002**	(−2.38)
Age	−0.004***	(−3.36)	−0.001	(−0.74)
Square of age	0.000**	−3.03	0.000	−0.74
Gender of respondent	0.013*	−2.26	−0.004	(−0.83)
Locality of residence	−0.105***	(−12.65)	−0.547***	(−91.76)
Pre-basic education	0.047	−1.65	−0.033	(−1.75)
Basic education	−0.023	(−0.81)	−0.022	(−1.21)
Secondary education	−0.083**	(−2.88)	−0.025	(−1.31)
Post-secondary education	−0.109***	(−3.69)	−0.043*	(−2.22)
Western region	−0.026*	(−2.22)	0.127***	−13.88
Central region	0.007	−0.57	0.672***	−68.52
Volta region	0.028*	−2.17	0.154***	−15.54
Eastern region	−0.001	(−0.09)	0.592***	−67.19
Ashanti region	−0.062***	(−5.39)	0.052***	−5.89
Brong Ahafo region	−0.017	(−1.20)	0.051***	−4.86
Northern region	0.103***	−6.57	0.550***	−46.08
Upper East region	0.069***	−4.46	0.421***	−35.74
Upper West region	0.260***	−18.2	0.195***	−17.44
athrho	−0.29066	−6.03	−0.9953756	−19.11
lnsigma	−1.056589	−110.91	−1.289019	−77.35
rho	−0.2827422		−0.7596452	
lambda	−0.0982924		−0.2093134	
sigma	0.3476397		0.2755411	
Observations	15,554		15,554	