YOUNG LIVES STUDENT PAPER

Child Work and Academic Achievement: Evidence from Young Lives in Ethiopia

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The data used come from Young Lives, a longitudinal study of childhood poverty that is tracking the lives of 12,000 children in Ethiopia, India (in the states of Andhra Pradesh and Telangana), Peru and Vietnam over a 15-year period. **www.younglives.org.uk**

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Contents

List of Tables

List of Figures

1. Introduction

Returns on human capital investments can take time to realize, so most human capital investments are made in the first stages of life. Schooling is crucial for human capital formation, and it is a human capital investment which mainly happens during childhood. As children grow, additional activities, such as work, start to gain importance in children's time allocation decisions. Spending a considerable amount of time doing such activities that are not related to schooling might have effects on children's learning processes (both negative or positive), with potential effects on their human capital accumulation. This paper studies the effect of child work on academic achievement in the context of Ethiopia.

Child work has been in the national and international agenda as a social issue for centuries. Bourdillon et al. (2010, chapter 3) summarize the history of regulation in child labor. The first labor laws that attempted to protect child workers were created in Britain: Act for the Better Regulation of Chimney Sweeper and their Apprentices (1788), Factory Health and Moral Act (1802),[1] Cotton Mill and Factories Act (1819) and the Factory Act (1833). Regulations have been incorporated in many other countries since the nineteenth century. In addition, international organizations, such as the International Labor Organization (ILO), have played a role mainly on minimum age conventions starting with industrial employment in 1929, and continuing with the 1973 Minimum Age Convention 138 and the 1999 Worst Forms of Child Labour Convention 182.

Bourdillon et al. (2010), in a recent seminal book, explain the importance of understanding child work holistically. While the work that children do is often seen as detrimental to their welfare, it may or may not interfere with school and schoolwork; it could be complementary in some cases, or it could provide the means to afford schooling. Some work activities could provide a different set of skills that prepare children for the

[1] For children working in textile mills.

economic environment in which they live. Therefore, child work can affect children's learning in both positive and negative ways.

The relationship between child work and schooling outcomes has been broadly studied by economists.[2] But this research can be divided into two categories: one that analyses time in school (enrolment, attendance, dropouts) and another one that analyses learning (school attainment, test scores). Although these measures capture an important aspect of children's development, they are somewhat limited. Other disciplines analyze complementary dimensions of child development, such as the psychological, physical and social.

Research related to time in school provides evidence that children who perform working activities are less likely to attend school (Ray and Lancaster, 2003; Ravallion and Wodon, 2000). But social programs, such as the conditional cash transfers in developing countries, have aimed to keep children in school and increase enrollment rates. Saavedra and Garcia (2012), found that these programs were more effective for secondary than primary enrollment rates.

On the other hand, studies analyzing the effects of child labor on school attainment have concluded that working children complete fewer years of schooling or have lower schooling for age (Ray, 2002; Psacharopoulos, 1997; Khanam and Ross, 2008). Some authors have explored the relationship between child labor and school performance in Africa (as measured by test scores[3]); they conclude that children engaged in market activities[4] perform worse in school (Akabayashi and Psacharopoulos, 1999; Heady, 2003), while studies of Latin America provide mixed evidence. On one hand, Gunnarsson, Orazem, and Sánchez (2006) show that child labor lowers test scores, yet

[2] Edmonds (2007) provides a comprehensive review of the child work literature.
[3] From the economics perspective, in the context of developing countries, analyzing test scores could provide information on later human capital outcomes. Hanushek and Woessmann (2008) showed that cognitive skills explain better than school attainment the impact of schooling on individual earnings, the distribution of income, and economic growth.
[4] These activities include farm activities and paid work, but do not include domestic work.

other studies find little or no effect (Binder and Scrogin, 1999; Patrinos and Psacharopoulos, 1997).

Child work and school attendance are jointly determined outcomes of an individual's time allocation within the household: this implies that estimation of the effect of child work on schooling outcomes may suffer from simultaneity bias. Several studies have acknowledged this endogeneity problem, others have not addressed this issue. Endogeneity could make estimation of the impact of child work on academic achievement challenging; endogeneity could be a result of simultaneity bias or measurement error.

Simultaneity in the context of this paper can come from omitted variables (which will be absorbed by the error term) or from endogeneity, the latter of which can be illustrated with an example. On the one hand, a child that works in his/her parents' business could gain numeracy skills that might increase his/her math test scores. In contrast, the household might decide that a child who performs poorly at school should allocate more time to household farm work rather than studying or attending school because the expected future returns on the child's human capital are low. Instrumental variables estimation has been the most commonly used empirical method to overcome endogeneity in the form of simultaneity (Orazem and Gunnarsson, 2004). Edmonds (2007) concludes that when instrumental variables are not used, the effect of child work on the education outcome will be underestimated.

Another source of bias comes from measurement error. In the context of this paper, it can come from measurement error of the right-hand side variables. The key variable in this paper is reported hours performing different types of child work. The data used for the empirical results uses hours of child work reported by an adult in the household. This measure is available for all children included in the sample, and it is the most comparable variable measured in the dataset. For the oldest children in the household, self-reported data on hours of child work is available, thus, Appendix 1

reports an alternative model specification using the self-reported data as the dependent variables. This allows one to verify if the coefficients of interest behave differently when using a different respondent for the same question.

Very few studies have examined the relationship between child work and academic achievement in Ethiopia. The few that have used data from the 1990s. The few studies that do exist do not analyze the impact of child work on academic achievement in the context of a production function for learning, or how child work affects the quantity of schooling that children obtain. Instead they study the determinants of child work and its relationship with current school attendance. For example, Alvi and Dendir (2011) show that the oldest child in the household has a larger probability of simultaneously attending school and participating in market work; with a larger probability for boys residing in urban areas. They also show that domestic work is mainly performed by girls. Haile and Haile (2012) study the determinants of work participation and school attendance of rural children aged 7 to 15; they find that the educational attainment (measured as grade for age) of working children decreases when they work long hours. Cockburn and Dostie (2007) analyze the relationship between asset accumulation, child work, and schooling; they find that household composition and a household's asset profile are crucial determinants of the demand for child labor and conclude that households might be encouraged to withdraw their children from school when participating in asset accumulation-based poverty alleviation policies, such as a program that promote ownership of farm tools or adoption of perennial crops. Only one study includes test scores in the analysis: Cockburn (2002) shows that work activities do not prevent children from attending school, but the correlation between test scores and multiple work activities and weekend work hours is negative.

These studies on child work and schooling in Ethiopia provide evidence of a negative correlation between hours of work and education outcomes, but none of them addressed endogeneity and thus they are unlikely to estimate the causal effect of child work on test scores. This paper contributes in three distinct ways to the existing literature

on understanding the dynamics of the relationship between child work and learning in the Ethiopian context. First, it uses a more recent dataset. Second, it examines the causal effects of child work on academic achievement by considering the potential for reverse causality, which has rarely been addressed in previous studies. It also includes tests score data for children that are not enrolled in school. Finally, it differentiates the effects of performing two different types of work (domestic work and market work) on learning (as measured by test scores).

This paper uses the term child work instead of child labor. The term child labor is usually associated with types of work that are harmful for children. But in this paper, I consider a broader range of work activities: i) paid work outside the household; ii) unpaid labor force work for the household; iii) domestic chores; and iv) time spent caring for other household members. Human capital formation is measured through vocabulary and mathematics test scores, which capture literacy and numeracy skills, which is just one aspect of children's development.

2. Child Work and Education in Ethiopia

Ethiopia has ratified the United Nations convention on the Rights of the Child, has signed the ILO convention on required minimum working age (Minimum Age Convention, 1973, No. 138), and has prohibited employing persons under 14 years of age (Proclamation No 42/1993, Chapter II, Section 89, (2)), but child work is still widespread in the country and has been a topic of interest in the national policy agenda.

Since 1993, Ethiopia has been implementing a series of educational reforms in order to provide better access to education, which include: i) Proclamation 41, in 1993; ii) the Education and Training Policy and the Education Sector Strategy adopted in 1994; iii) the Teacher's Career Structure was established in 1995 (Unesco, 2006). The Constitution was amended in 1995 to state that education should be provided without religious, political and cultural considerations, and that the state has the obligation to allocate resources to provide educational services. Primary school enrollment rates have increase

dramatically since these reforms were implemented, but access to higher levels of education, the quality of education, and gender and urban-rural education gaps are still a serious problem. This section describes in more detail the most recent trends for child work and some education indicators in Ethiopia.

2.1 Child Work

This paper uses two different measures of child work: market work (which combines paid work outside the household with unpaid labor force work for the household) and domestic work (which includes domestic chores and time spent caring for other household members).

The most comprehensive survey of child work in Ethiopia, the Child Labor Survey, was carried out by the Central Statistical Authority of Ethiopia (CSA) in 2001.[5] The survey showed that 85 percent of the country's children aged 5 to 17 performed market or domestic (housekeeping) activities during the reference week. Boys were more likely to participate in market activities, while domestic activities were mainly performed by girls (CSA, 2002).

The report showed that most children started working at a very early age: 39.1 percent of the children started at or by the time they had reached 5 years of age and another 43.3 percent started between the ages of 6 and 7 years old (CSA, 2002).[6] Children participating in market activities were mainly unpaid family workers engaged in agriculture, which in the context of Proclamation No. 42/1993 is legal. More than one third of children aged 5 to 17 participating in market activities worked for 40 or more hours per week. They spent, on average, 32.8 hours a week in productive activities. In addition, the report shows that 77 percent of the children who were engaged in domestic

[5] The 2001 is the only national child labor survey that has been carried out in Ethiopia. The survey was funded by the International Labor Organization and the Government of Ethiopia.
[6] The survey asked whether the child started to work when he/she was “5 or less years”, so it is not possible to know how many children started to work at exactly age 5.

activities spent more than 3 hours per day on these tasks. Girls spent more hours working on domestic activities than boys.

Using the 2013 (Round 4) data from the Young Lives study,[7] it is clear that Ethiopian children are still actively engaged in both market and domestic work activities, Figures 1a-c show the average number of hours worked in a typical day (including children that reported zero hours on any of these activities), first for all children living in households that were surveyed by the Young Lives study and then separately for boys and girls. On average, children aged 5 years old worked at least one hour per day. The number of hours worked per day rapidly increases for children between 5 to 8 years old, and stabilizes at around 4 hours of work per day when children reached 10 years of age. Consistent with the data from the 2001 Child Labor Survey, Figures 1b and 1c show that girls spend most of their working time on domestic chores, while boys spend most of their time on market work. At the time of the ILO survey, Ethiopian schools functioned in 4-hour shifts (morning and afternoon groups of students), but in 2005 the government implemented a reform to lengthen the school day to 6 hours.

2.2 Education

In 1994, Ethiopia adopted a new Education and Training Policy, which introduced free primary education.[8] Ethiopia's commitment to expand access to education is reflected by the increase in public expenditure on education as a percent of GDP, which almost doubled in 10 years from 2.4 percent of the GDP in 1993 to 4.5 percent in 2013. During these decades, the school aged population almost doubled, while the economy was growing at a faster rate (real GDP tripled during the same period).

Public expenditure on education represented 10.8 percent of total government expenditures in 1993 and 27 percent in 2013. This expenditure focused on primary

[7] The Young Lives data will be described in detail in section 2.3.
[8] Compulsory schooling in Ethiopia lasts for 8 years (from 7 to 14 years old) and comprises two cycles of primary education: 1st cycle (grades 1 to 4) and 2nd cycle (grades 5 to 8).

schooling (75.8 percent in 2010). Some of the most recent policies include: increasing the number of primary schools from 6,958 in 2000 to 32,048 in 2013 (as a result of the government's effort to provide all children a primary school option within walking distance from their homes), providing instruction in each student's mother tongue (23 languages), and increasing the minimum qualifications to become a primary school teacher (Unesco, 2015).

Ethiopia's primary school enrollment rate is currently high. In 2013, according to UNESCO (2015), the gross primary school enrollment rate was 101.3 percent and varied widely by region, ranging from 74.4 percent in Afar to 154.6 in Addis Ababa.[9]. The gross primary enrollment rate for boys was slightly higher than that for girls (104.8 percent vs. 97.8 percent). Historically, the gross secondary enrollment rate has been much lower, but it also increased from 10.5 percent in 1995 to 39.3 percent in 2013.[10]

In addition to low enrollment rates in higher grades, there are still disparities in educational attainment between girls and boys. Although the difference in the primary completion rate by gender has decreased, in 2014 there was still a small gap: 53.3 percent for girls and 54.0 percent for boys.[11] This education gender gap is much larger for older generations: in 2015, the youth literacy rate (ages 15-24) was 67.8 percent for young women and 71.1 percent of young men, while for adults 25 years or older the literacy rate was approximately 26.4 percent for women and 33.3 percent for men.[12]

[9] This paper uses data from five regions of the country, while the UNESCO report presents data for 11 regions. The gross primary enrollment rates from the regions included in this paper are: Addis Ababa (154.6 percent), Amhara (106.7 percent), SSNPR (102 percent), Oromia (91.2 percent), and Tigray (106.2 percent).

[10] Secondary education is composed of two cycles: general secondary education (grades 9-10) and preparatory classes (grades 11-12). At the end of grade 10, students take the Ethiopian General Secondary Education Certificate Examination in order to select students to continue on to the preparatory classes or to technical and vocational education (UNESCO, 2015).

[11] http://data.worldbank.org/data-catalog/world-development-indicators

[12] http://www.uis.unesco.org/das/Country/Literacy?code=ETH&regioncode=null&SPSlanguage=EN Retrieved in January 8, 2016.

A final problem is that, despite the government's efforts to improve education outcomes, the quality of education remains one of the main challenges in Ethiopia; the pupil-teacher ratio is 64.3 for primary education, and the percentage of trained teachers in primary education is low (56.8 percent in 2012), which are likely due to the rapid expansion of coverage of the primary level. A further sign of a reduction in education quality is that the National Learning Assessment (NLA) test scores fell from 2000 to 2008, and more than half of the grade 12 students (secondary education seniors) did not attain basic competencies (Joshi, 2012). Therefore, for upcoming generations, school enrollment does not seem to be the biggest challenge, but given the recent trends, school quality remains a challenge that has serious consequences for learning.

3. Theoretical Framework and Empirical Strategy

This section presents the theoretical framework followed by this paper, which serves as a reference to the empirical strategy used to estimate the impact of child work on academic achievement.

3.1 Theoretical Framework

Academic achievement is assumed to be the result of a human capital production function, so it reflects how much a child learns and not only attendance or enrollment. I follow a model developed by Orazem and Gunnarson (2004) that shows the relationship between a child's time allocation and education outcomes.

Some children transition from school to the labor market only after they become adults, but most children go through a transition period during which they devote time to both school and work (performing different chores as children or teenagers). Orazem and Gunnarsson (2004) modelled a child's time allocation decision using a three-period model. The key assumptions of the model are: i) returns to years of schooling are positive, but are a decreasing function of the number of years of schooling; and ii) households decide how to allocate their child's time between labor (L) and school

attendance (A) to maximize the present value of the child's lifetime earnings. The first assumption seems reasonable for the case of Ethiopia, in fact, Montenegro and Patrinos (2014) showed that Ethiopia is one of the countries with the highest returns to schooling in the world, especially for women. The second assumption need to be considered with caution; it assumes that households are altruistic and that even if the future is unknown for them, they are considering it when making time allocation decisions. Chuta (2017), in a recent study of young married women in Ethiopia, shows that the intra-household dynamics varied by area of residence (urban-rural) and by whether these women were living in their parents' house or with their husband. Urban women have more bargaining power in relation to education, work and education decisions when living with their parents; in the case of rural women, parents are the main decision makers, and sometimes they do not consider the women's best interests when making decisions regarding education or work. Rural women also have less bargaining power than urban women when married; decisions regarding education and work are mainly made by their husbands. Taking into account Chuta's (2017) findings, it is likely that Orazem and Gunnarson's second assumption does not hold, especially for girls. In the case of Ethiopia parents might not maximize the present value of their child's lifetime earnings; parents might give a larger weight to the present and not maximize the lifetime earnings of each member of the household, but the overall household present welfare.

Orazem and Gunnarson's model includes two additional assumptions: households do not face any constraints to borrowing against future returns of schooling, and leisure time is ignored. Since 1994, public education is tuition fee-free in Ethiopia. [13] Recent data from the Living Standards Measurement Study (LSMS) household survey shows that more than 50 percent of the households spend less than 100 Birr on annual primary school expenses (CSA and World Bank, 2017).[14] Except for Addis Ababa, more than 90

[13] A consequence of the educational reform in Ethiopia in the 1990s, Proclamation No. 41 of 1993 and the Education Training Policy of 1994, is that education from grades 1 to 10 would be fee-free (Chicoine, 2016).

[14] One hundred Birr represent about 1 percent of Ethiopia's per capita income.

percent on households spend less than 500 Birr on primary school expenses per year. In the case of secondary school education, school expenses are higher; the LSMS data show that more than 90 percent of the households spent more than 150 Birr on secondary school expenses per enrolled child in the academic year preceding the survey. Therefore, although returns for school are high in the country, households may face borrowing constraints to make investments in secondary and tertiary education, as fees increase for higher levels of education.

In the model, the time constraint for each period is given by: $A + L = 1$. During childhood (period 1), the child spends all his or her time in school: $A = 1$. Period 2 is the transition period in which the child divides her time between attending school and working: $0 < A < 1$. Finally, in period 3, adulthood, the child works full time: $A = 0$.[15]

The model is solved by considering the wage that the child can claim in periods 2 and 3, as a function of the total marketable skills accumulated (H), and the interest rate *r*. If the present value of the wage differential attributable to schooling exceeds the marginal cost of the child's time in school, the child will attend school. In this model, human capital accumulation (*H*) depends on years spent attending school, following the work of Mincer. Recent research has shown that cognitive skills explain better than school attainment the impact of schooling on individual earnings (Hanushek and Woessmann, 2008), especially in the context of a developing country. Thus, the human capital production function should include a measure of academic achievement, instead of a measure of school attendance. The structural relationship between child work and human capital is defined by the following production function:

$$H_{ij} = H(L_{ij}, X_{ij}, Z_j, H_{0ij}) \qquad (1)$$

[15] As mentioned in section 2.1, most children start working at young ages, even before going to school. Almost 40 percent of children started to work before they were 5 years old. Therefore, for the case of Ethiopia, period 1 of the model might not exist, the time constraint should start with period 2.

where H_{ij} stands for a measure of academic achievement of child i in household j, child work (defined below) is captured by L_{ij}; X_{ij} is the child's characteristics, Z_j includes attributes of the parents and household, and H_{oij} is the past accumulation of human capital. The goal of this paper is to estimate the effect of child work (L_{ij}) on different measures of academic achievement.

This paper extends the framework presented in this section by making a clear distinction between the effect on school achievement of two types of child work: domestic work and market work. Thus, child work (L) is determined by the time spent on domestic activities and market work: $L = Dom + Mkt$.

3.2 Effects of Child Work on Test Scores

Equation (2) shows a linear specification of equation (1). In this specification, the dependent variable is a test score

$$H_i = \alpha_0 + \beta_1 Mkt_i + \beta_2 Dom_i + \sum_{k=1}^{n} \rho_k X_{ki} + \sum_{l=1}^{n} \gamma_l Z_{li} + \theta H_{0i} + \tau_C + \varepsilon_i \qquad (2)$$

Test scores are a function of the daily hours allocated to market (*Mkt*) and domestic (*Dom*) work on a "typical" day,[16] a vector of child characteristics X (gender and age in months), a vector of parent/caregiver and household characteristics Z (whether a parent is the primary caregiver, educational attainment, absence of one or both parents, household size and composition, wealth quintile, and geographic location), and the child's past accumulation of human capital (H_{0i}). The variable τ_C allows for community-specific fixed effects and ε_I is an error term. Community-specific fixed effects represent the unobserved differences among communities that influence education, such as school and teacher quality. Equation (2) includes all the variables of the production function, thus the

[16] The Young Lives data defines a typical day as follows: "***Typical day:*** *typical means 'usual', so it does not include something the child does irregularly, for example during festivals. Therefore, a typical day is a day from Monday to Friday, excluding holidays, festivals, days of rest during the weekend, etc*." Extract taken from the Fieldworker Manual, Ethiopia, Round 4, pg. 34.

error term represents measurement error of the dependent or control variables, or omitted variables in the production function.

The coefficients of interest are β_1 and β_2, which capture the effects of an increase in the number of hours devoted to market or domestic work on academic performance. The sign of the coefficients is uncertain, when taking into consideration the existing literature. But one might expect that, given the differences in the type of activities performed by boys and girls and the time allocated to each of them, the coefficients for each type of child work will be different between boys and girls and those coefficients could also vary with age. Therefore, equation (2) will be estimated separately for boys and girls.

3.3 Effects of Child Work on School Performance using 2SLS

The household's decision on the allocation of a child's time to different types of work could be influenced by the parents' observation of the child's performance in school. For example, a child performing poorly in school might have his/her hours of house work or work on the family business increased because of the parents' perception that the skills gained by performing these types of activities might yield higher returns in the future than those that come from schooling. Therefore, there is potential for reverse causality in the estimation of child work on schooling outcomes, which implies that OLS estimates of equation (2) may yield biased estimates. Endogeneity has been widely recognized in the child work literature, but not necessarily incorporated in the empirical analysis, mainly because of lack of valid instruments in most data sets. Previous analyses of the relationship between child work and schooling outcomes have used instrumental variables estimation to overcome endogeneity. Orazem and Gunnarsson (2004) provided examples of instruments that have been traditionally used: child wages and legal variation.[17] Additionally, they pointed out that when correcting for endogeneity of child work using instrumental variables, the estimated impact of child work on test scores

[17] Legal variation includes differences in school starting age, preschool programs in the country, as well as the capacity to enforce laws on child labor in the country (Orazem and Gunnarsson, 2004, pp. 19).

usually might become more negative. Gunnarsson (2003) found larger child labor effects on test scores for 3rd and 4th graders in 10 countries of Latin America, Bezerra et al (2009) estimates on test scores for secondary school Brazilian children are larger after controlling for endogeneity, and Beegle et al. (2008) found larger effects of hours of work on schooling years after instrumenting child labor for children in a longitudinal data set in Tanzania.

Finding a valid instrument is the main challenge for an instrumental variables approach. As discussed above, daily hours allocated to market and domestic work are endogenous variables in equation (2), the equation for academic achievement. Thus, the time allocation decision is modeled using a first stage equation. The first stage has the same equation for both market and domestic work. I propose to instrument the time allocation decisions for the child with a set of variables included in a vector of sibling composition variables ($SiblingComp$), a vector of household shocks ($HhldShocks$), and a vector of environmental shocks ($EnvSchocks$). These instruments will be discussed in detail in subsection 4.2.

$$HrsWk_{icr}{}^{S} = \alpha_0 + \sum_{l=1}^{n} \varepsilon_l SiblingComp_{licr} + \sum_{l=1}^{n} \varphi_l HhldShocks_{licr}$$

$$+ \sum_{l=1}^{n} \mu_l EnvShocks_{licr} + \sum_{l=1}^{n} \rho_1 X_{licr} \sum_{l=1}^{n} \gamma_l Z_{li} + \tau_c + \varepsilon_{icr}, s \in \{Market, Domestic\} \quad (3)$$

The dependent variable, $HrsWk_{icr}$, indicates the daily hours allocated on a typical day to market or domestic (separately) work by child i, who resides in community c, in round r. The variables included in the set of sibling composition instruments are proportions of older sisters, older brothers, younger sisters, and younger brothers, relative to the total number of siblings. It is expected that the way these instruments affect domestic and market work will differ by the child's age and gender. Emerson and Souza (2002) show that, in Brazil, earlier-born boys and girls with younger siblings are more likely to work in the labor market (and family farm). This might be explained by the fact that when families cannot afford to send their oldest son/daughter to school, those children start to

work. So, when families have more resources, they could start sending their youngest children to school. Edmonds (2006) shows that in Nepal, having a larger number of older sisters decreases the probability of domestic work for younger boys and girls. Other authors have shown that girls spend more hours on domestic work when there is a larger number of younger siblings (Edmonds, 2006; Parish and Willis, 1993).

The first set of shocks includes household shocks that could affect the household labor supply such as illness or death of a household member, or a new member of the household. These shocks could affect the time allocation of the children in different ways. On one hand, if a household member gets ill, the number of hours of domestic work of other household members might increase (hours spent taking care of other household members).[18] Moreover, the effect could vary by gender and age of the child; girls are most likely to take over activities that are traditionally performed by women (cooking, cleaning), while boys are most likely to take over family farms or businesses. The second set of shocks include the following environmental shocks faced by the household in the past 4 years: drought, flood, frost, and death of livestock. The relationship between these types of shocks and child work relies on the fact that one of the dimensions of child work is that it can serve as a self-insurance strategy of the household. Kochar (1999) and Jacoby and Skoufias (1997) find that hours of market work increase when households in India face crop shocks. When households face these types of shocks, and they are credit constrained, it is difficult to borrow to mitigate the effect of the shock, but households can reallocate the time of their children to maintain the production levels in the farm or business affected by the shock.

[18] There is a direct effect that could happen if the person who dies or gets ill helps the child with his/her homework. Data on who helps the Young Lives child with homework is available for Round 4; it shows that children mainly rely on their older siblings (36 percent) if they need help with homework; followed by nobody (34 percent), father (10 percent), other family members (8.5 percent) and mother (5.3 percent). Thus, any bias in the IV estimates due to this direct effect is likely to be minor.

Similar to equation (2), the first stage regression includes a vector of child characteristics *X* and a vector of parent and household characteristics *Z*, but the coefficients are different to those in equation (2).

The relevance assumption of the instruments is tested in section 5 by analyzing the first stage of the two-stage least squares (2SLS) specification. F-statistics of the first stage serve as a test for weak instruments, and the Hansen J-statistic is reported as an overidentification test of the exclusive restriction on the instruments.

4. Data

4.1 The Young Lives Study in Ethiopia

This paper uses data from the Young Lives study,[19] a research program at Oxford University that studies childhood poverty in four developing countries.[20] The Young Lives study has implemented surveys of 12,000 children, their households, and their communities over a span of eleven years. Currently, four rounds of the survey data are available for Ethiopia (2002, 2006, 2009, and 2012). In each round, two cohorts were surveyed: children born in 2000/01 (the "younger cohort") and children born in 1994/95 (the "older cohort"). There are approximately 3,000 observations per country for each round: about 2,000 for the younger cohort and about 1,000 for the older cohort.

Data on time use for the Young Lives children and other children aged 5 to 17 in the household have been collected since the second round of the survey, thus this paper uses data from Round 2 (2006), Round 3 (2009), and Round 4 (2013). More specifically, this analysis uses the time use data from Rounds 3 and 4 for the younger cohort and from Rounds 2 and 3 for the older cohort. These children were surveyed when they were 8 years old (younger cohort, Round 3), 12 years old (younger cohort, Round 4 and older cohort, Round 2), and 15 years old (older cohort, Round 3). In Round 4, children from

[19] http://www.younglives.org.uk/

[20] Young Lives has similar data for India (state of Andhra Pradesh), Peru, and Vietnam; therefore, the analysis could be replicated for these countries.

the older cohort were around 18 years old, as this study focuses on child work, they are excluded from the analysis. See Table 1, which summarizes the survey rounds and children included in this analysis.

The Young Lives study surveys children residing in five (out of nine) regions of Ethiopia: Addis Ababa; Amhara; Oromia; Tigray; and the Southern Nations, Nationalities, and People's Region (SSNP). [21] This is shown in Figure 2. When surveying children in these regions, Young Lives intentionally oversampled the poor population in order to build a "*comprehensive picture of what poverty means for children in Ethiopia today*."[22]

The Young Lives questionnaire includes different sections to be answered by the children and adults in the household. The child-level section includes demographic and educational variables of the child and his/her parents, test scores, and information on different types of activities, such as school, market work, and domestic work. The household section, answered by the caregiver or one of the adults present in the household, includes variables on household composition, dwelling infrastructure, and expenditure on different items, such as education. Very importantly for the purposes of this paper, the Young Lives data also include time use data for all children aged 5 to 17 residing in the household (as reported by the caregiver or one of the adults in the household).

For the younger cohort's empirical analysis, 1,875 children were interviewed in Round 4. Of those 1,875 children, 396 did not complete the vocabulary test (Peabody Picture Vocabulary Test, or PPVT) and 185 additional children did not complete the Mathematics test in Round 3 or 4. In addition, 86 children were dropped from the sample because of missing data on the control variables. Thus, the total number of children

[21] Some of the children interviewed in Round 4 had migrated to other regions of the country, as shown in Table 1b, they represent less than 1 percent of the sample.
[22] http://www.younglives-ethiopia.org/

included in the younger cohort analysis is 1,208.[23] There is potential selection bias, due to the fact that a large percentage of children whose first language is one of the language minorities did not complete the vocabulary test (see Table 2). For example, in Round 4, more than 97% of the children whose first language is Hadiyigna or Sidamigna did not complete the PPVT test.

From the 1,000 children included at the beginning of the study for the older cohort, 29 children were not interviewed in Rounds 2 and 3. Of the remaining 971 children in Round 3, 51 children did not take the Mathematics Achievement Test in either round and 35 did not took the PPVT test in either round. Finally, 103 children were dropped from the sample because of missing data on the control variables. Thus, the total number of children included in the older cohort analysis is 782. [24] Tables 3a-d report the summary statistics for the final samples by survey round, cohort, and child work category (domestic and market work). Columns 1 and 2 report the means and standard deviations of the all variables included in the analysis. For the purposes of the descriptive analysis, additional columns are reported on Tables 3a-d to show differences in the variables of interest between the whole sample and children who worked more than three hours per day or per each type of work. The statistical analysis is not restricted to these children. Columns 3 and 4 show the means and standard deviations for children working more than three hours per day.[25] Summary statistics for children engaged in market work for at least

[23] For Round 3, 165 children did not complete the PPVT test and 211 children did not complete the mathematics test. For Round 4, 274 children did not complete the PPVT test and 291 children did not complete the mathematics test. The results for the PPVT test score use the sub-sample of children who took the vocabulary test (1,527 for Round 3 and 1,346 for Round 4) and the results for the Mathematics test score use another sub-sample of children who took the corresponding test (1,489 for Round 3 and 1,328 for Round 4).

[24] For Round 2, 26 children did not complete the PPVT test and 31 children did not complete the mathematics test. For Round 3, 10 children did not complete the PPVT test and 35 children did not complete the mathematics test. The results for the PPVT test score use the sub-sample of children who took the vocabulary test (826 for Round 3) and the results for the mathematics test score use another sub-sample of children who took the mathematics test (810 for Round 3).

[25] Which represent 60.3 percent of children aged 8 years, 69.4 percent of children aged 12 years of the younger cohort, 75.1 percent of children aged 12 years of the older cohort, and 82.5 percent of children aged 15 years.

three hours per day are reported in columns 5 and 6,[26] and columns 7 and 8 show the means and standard deviations of the variables for children working more than three hours on domestic activities.[27]

4.1.1 Schooling Outcomes

Test scores are the academic achievement measure used in this analysis. More specifically, the analysis focuses on two of the cognitive tests administered as part of the Young Lives survey: the Peabody Picture Vocabulary Test (PPVT) and the Mathematics Achievement Test. This section describes the raw test scores; however, test scores were standardized for the statistical analysis; therefore, the estimated impacts of child work on academic achievement from the statistical analysis are measured in terms of the standard deviations of the test score variable.

The PPVT is a vocabulary test which was administered in all rounds to children in both cohorts. The test consists of selecting a picture that best represents the meaning of a word presented orally by the examiner. For Rounds 2 and 3 it included 204 words and for each correct answer the child received one point (Cueto and Leon, 2012). For the younger cohort in Round 3, the average test score was 84.9; for the older cohort, in Round 2 the average score was 77 and for Round 3, the average score was 152. For Round 4, the PPVT test that was administered to the younger cohort included only 55 words, and the average score was 39.3. In Ethiopia, this test could be taken in fifteen different languages.

The format of the Mathematics Achievement Test for the younger cohort in Round 3 included 29 items, divided into two sections. The first section included nine questions on basic quantitative and number notions, while the second section of 20 questions measured the ability to perform basic mathematics operations with numbers

[26] Which represent 27.5 percent of children aged 8 years, 31.7 percent of children aged 12 years of the younger cohort, 27 percent of children aged 12 years of the older cohort, and 28.3 percent of children aged 15 years.

[27] Which represent 34.8 percent of children aged 8 years, 38.5 percent of children aged 12 years of the younger cohort, 49.1 percent of children aged 12 years of the older cohort, and 60.4 percent of children aged 15 years.

(see Cueto and Leon, 2012, for further details) The average test score for this cohort in Round 3 round was 7.4. The format of the test was similar in Round 4 but included 28 items divided into a first section that was comprised of 19 items dealing with addition, subtraction, multiplication, division, and square roots; the second section included 9 items on mathematics problem solving. The average test score for the younger cohort in Round 4 was 10.8. Columns 3, 5 and 7 of Tables 3a and 3b show that children who worked more than 3 hours per day had much lower average mathematics test scores, but recall that this cannot be interpreted as a causal impact.

The format of the Mathematics Achievement Test for the older cohort differed from Round 2 to Round 3. In Round 2, the test consisted of 10 items evaluating topics of number and number sense (Cueto, Leon, and Munoz, 2009). The average test score for this round was 5. In Round 3, the test consisted of 30 items divided into two sections. The first section was comprised of 20 items dealing with addition, subtraction, multiplication, division, and square roots; the second section included 10 items on mathematics problem solving. (Cueto and Leon, 2012). [28] The average test score was 5.9.

4.1.2 Child Work

This paper uses direct measures of child work, distinguishing between market and domestic work. As mentioned before, most of the previous studies analyzing the relationship between child work and test scores have used market labor as the child work measure. Assad, Levison, and Zibani (2010) showed that lower school attendance of girls in Egypt is associated with the intensity of domestic work; thus, incorporating domestic work into the analysis of school performance could unmask some aspects of child work that were not captured in most previous studies.

In the Young Lives study, data on child work are reported in hours of work on a "typical" day for four different categories of work: i) paid work outside the household; ii)

[28] The last 10 questions of the Mathematics Achievement Test for the older cohort in Round 3 were multiple choice.

unpaid labor force work for the household (work on family farm, cattle herding, shepherding or other family business); iii) domestic chores (fetching water, firewood, cleaning, cooking, washing or shopping); and iv) time spent caring for other household members (younger siblings, elderly or ill household members).

For the purposes of this analysis, child work is measured by two variables: market work (paid work outside the household and unpaid labor force work for the household) and domestic work (domestic chores and time spent caring for other household members). In the case of market work, the two types of activities included in the measure could have completely different working conditions, Orkin (2012) provides a clear description of these conditions for the children in the Young Lives older cohort residing in rural sites. Paid work usually involved planting or harvesting, with the condition of finishing the day's work to be paid or to be able to leave to attend school. In contrast, work in the family business had a more flexible and the task could be divided in small periods of time. The percentage of children reporting hours of work of paid work was less than 4 percent in the sample, therefore the sample size was too small to perform a statistical analysis of the different types market work separately.

Hours of work on a "typical" day were reported separately by one adult present in the household and by the Young Lives child participant. The main results reported in this paper used hours of work reported by the adult in order to have a comparable measure for children of different ages (different cohorts and different rounds), but data reported by the child were used to account for potential measurement error, given that older children might have a better idea on how they spend their time.[29] The measure of paid work outside the household might be underestimated given that the reference period was a typical day. As discussed by Orkin (2012), children involved in paid work usually engage in the activity during the weekends or school holidays.

[29] Although the answers might differ, the self-reported data is highly correlated with the data reported by an adult in the household. For the older cohort, Round 2, the correlation coefficient for domestic work is 0.756 and for market work is 0.807; for the older cohort, Round 3, the correlation coefficient is 0.888 for domestic work and 0.928 for market work.

Tables 3a-d report the average hours spent working on a typical day, overall and conditional on doing more than 3 hours of work. For all children aged 8 years old (including children that did not work), 92 percent of worked at least 1 hour per day, on average, and they spent 3.6 hours per day working, distributed between market work (1.4 hours) and domestic work (2.2 hours). As children grow, more of them work, and they work for more hours. Children of the younger cohort in Round 4 (12 years) spent 3.8 hours per day working, keeping the average hours of domestic work constant, but increasing their market work time to 1.6 hours. For the older cohort, Round 2 (12 years), 97 percent of the children worked at least one hour per day, and they spent 4.1 hours per day working, on average, distributed between market work (1.4 hours) and domestic work (2.7 hours). The oldest sample in the database is comprised of the older cohort in Round 3, when children were 15 years old. Ninety-nine percent of them worked at least one hour per day and the average number of hours increased to 4.8, distributed between market work (1.6 hours) and domestic work (3.2 hours).

For the purposes of the descriptive analysis, Tables 3a-d also report the variables of interest for children who spent more than three hours a day performing market and domestic activities. The percentage of boys engaged in market work for three or more hours per day ranges from 75 percent to 81 percent. In contrast, girls' engagement in market work (for three or more hours per day) ranges from 19 percent to 25 percent. The descriptive statistics in the case of domestic work show that girls are more engaged in this activity than boys. Girls' participation ranges between 65 percent to 70 percent and boys' participation represents 30 percent to 35 percent. This reaffirms the fact that the activities performed by boys and girls differed; domestic work is mainly performed by girls and market work is performed by boys (Assad, Levison and Zibani, 2010; Levison and Moe, 1998; Levison, Moe and Knaul 2001).

4.1.3 Child and Household Characteristics

The Young Lives data include detailed information about the child and his/her household and community. The empirical analysis includes, as additional controls, characteristics of the child (sex, age in months, and highest grade attained), characteristics of the child's parents (whether the caregiver is a parent, highest level of education attained by either of the parents,[30] and absence of the parents in the household), household composition (number of household members), household classification according to its wealth quintile, and geographic location.

Edmonds (2007) emphasized the importance of analyzing urban-rural differences; children in rural areas tend to work more often, and for longer hours. As shown in Tables 2.3a-d, 55 percent of the younger cohort children resided in rural areas, while 59 percent of children of the older cohort were in rural areas. In addition, the region in which the child resides was included in the analysis, using Addis Ababa as the reference category.

4.2 Instrumental Variables

In addition to the education and child work variables, as well as other controls, a set of instrumental variables will be used to address the endogeneity issues discussed in the empirical strategy section. These instruments were selected taking into account that they should not belong to the academic achievement equation (equation 2), and at the same time they must have explanatory power regarding the hours spent on domestic and/or market work, (equation 3). The instruments can be grouped in the following categories: sibling composition, household shocks, and environmental shocks.

[30] For children without data on the highest level of education attained by the parents, the information on the educational attainment of the caregiver was used. As shown in Tables 1a-d, sixteen percent of the children aged 8 years old had one parent absent and one percent had both parents absent from the household. In the case of children aged 12 years, for the younger cohort 22 percent of the children had one parent absent and five percent had both parents absent; for the older cohort 14 percent of the children had one parent absent and two percent had both parents absent from the household. Finally, 19 percent of the children aged 15 years old had one parent absent and two percent had both parents absent from the household. Only in Round 2, did the Young Lives questionnaire ask about the parental education when the parent is not present in the household.

The sibling composition instruments reflect the proportion of co-resident older/younger sisters/brothers relative to the total number of siblings present in the household. The survey does not include information about siblings living elsewhere. Although many demographers may argue that family structure is endogenous, in this case the instrument "sibling composition" takes into account two aspects, one is the number of brothers and sisters, and also the birth order of the Young Lives child. The importance of these variables relies on the fact that hours of domestic and market work could be affected by sibling composition. For example, a boy who has a large proportion of older sisters might be less likely to perform domestic chores, while a girl with a large proportion of older brothers might be less likely to take care of cattle in the fields. Tables 3a-d report the average number of older sisters, younger sisters, older brothers, and younger brothers for the different rounds and cohorts. The data reported in Tables 3a-d show that, in general, there is a smaller number of older brothers residing in the household, this could be explained by the practice of *Qenja*. *Qenja* is a practice in which only boys aged 8 to 18 years are involved. Boys are sent to either relatives or non-relatives to work in agricultural labor for a period of time after the child's family and the foster family develop an oral or written agreement. Kassa and Abebe (2016) studied the practice of *Qenja* in northern Ethiopia (Amhara region) and concluded that this practice also contributes to develop farming skills that children use later in life and allows children to save to either attend school or to use savings as a start-up capital later on.

The set of instruments related to household shocks includes dichotomous variables representing shocks faced by the household in the past 4 years that could affect the overall household's labor supply: illnesses of the mother, the father, or other household members, death of a household member, and births/new household members.[31] As seen in the bottom of Tables 3a-d (instruments section), most of the household shocks are related household members that that do not help with the homework,[32] therefore the

[31] This last shock includes birth of a household member or other people currently living in the household that were not living in the household in the previous round.
[32] See footnote 18.

test scores are unlikely to be directly impacted by these shocks. But the absence or inability to perform activities that these household members traditionally perform, might result on the reassigning tasks at home, and depending on the age and gender this could affect girls and boys differently. Chuta (2017, pp20) provides an example of how a household chore might be reallocated for a Young Lives girl whose mother was severely ill and this resulted on her dropping school and beginning to work in a stone crushing factory. Another way this could affect the child's time allocation of work is if the child's father gets ill: older boys might take over his duties in the field, while girls might have to take care of the father at home. The data reported on the instruments section of Tables 3a-d suggest that the children interviewed in Round 3 were affected by relatively few household shocks. For the younger cohort, the proportions of children living in households facing household shocks increased from Round 3 to Round 4. In contrast, the proportion of children living in household facing illnesses of a household member decreased from Round 2 to Round 3 for the older cohort.

The last set of instruments is the one that includes dichotomous variables representing environmental shocks faced by the household in the past 4 years. The bottom of Tables 3a-d reports the proportion of children facing environmental shocks. Environmental shocks can have an effect on the child's labor supply because most of the households included in the survey depend on agriculture. These types of shocks do not affect test scores directly, for example, when a drought happens it does not immediately have an impact on academic achievement, but it is through the reallocation of hours of work that it might influence test scores. Chuta (2017, pp20) provides an example that could illustrate this for another Young Lives girl: after a drought struck her village, the girl had to drop out of school and started to work at a stone crushing factory, do weeding at a farm, and sell cactus fruit. For all ages and rounds, the most common environmental shock is drought (ranging from 15 to 37 percent), followed by death of livestock (ranging from 18 to 30 percent), and flood (ranging from 7 to 12 percent).

5. Results

The estimates of the impact of child work on academic achievement for the Young Lives children in Ethiopia are presented in Tables 4-7. Each table summarizes the OLS and instrumental variables (IV) specifications using community fixed effects. Tables "a" summarize results for the standardized Vocabulary (PPVT) test scores and tables "b" for standardized Mathematics test scores. [33] Estimations using self-reported child work data are reported in Appendix 1.

The tables provide estimates for each age-group of children, both overall and disaggregated by gender. Some additional control variables are not reported in the tables: some parent's characteristics, number of household members, wealth quintile, and the community-specific fixed effects. The discussion will focus on the IV specifications; in most cases the direction of the OLS estimates is the same but, as expected, the IV coefficients are larger. When the direction of the OLS and IV estimator are different, this will be mentioned in the discussion.

5.1 Results for children aged 8 years- Younger Cohort

Tables 4a-b summarize the results for children in the younger cohort who were 8 years old at the time of the survey. In general, the results do not provide evidence of the direction of the effects and most of them are not significant.

The results of the first stage regressions estimating the determinants of domestic and market work are summarized in Table A.1 of Appendix 1. Sibling composition (a larger proportion of younger sisters or brothers) is the main determinant of domestic work for girls, while environmental shocks, such as drought and frost, are the instruments that explain market work for girls. In the case of boys, having a larger proportion of younger brothers living in a household and having faced flood are the main determinants

[33] Estimates for the average test score were also computed. The results do not differ from the main conclusion of this paper. The average test score measure does not provide insights of the type of skills that children were improving or worsening because of hours of child work, it was computed as part of the the statistical analysis in order to gain power to have more variance in the dependent variable.

of domestic work for boys, while sibling composition (a larger proportion of younger sisters or brothers) and environmental shocks such as drought and death of livestock are key determinants of market work for boys.

The Hansen J-Statistics and the F-tests reported in the bottom of Tables 4a-b show that, in general, the instruments are not weak and that there is little evidence that they violate the overidentification restriction. The F-statistic for domestic and market work is greater than 10 in most cases, therefore the instruments are not weak. The F-statistic for domestic work for boys ranges between 6.32 and 10.86, in which case the instruments for domestic work are weaker than those for market work. In addition, the p-value for the Hansen (overidentification) test is greater than 0.10 in most cases, which provides evidence that the instruments are valid. For the PPVT estimations for all children, and the mathematics estimations for all children and boys, the results fail the overidentification test at the 5 percent level, although not at the 1 percent level (see p-values for the Hansen test).

Table 4a reports the effect of child work on the vocabulary (PPVT) test score. The evidence shows that domestic work has a negative effect on the PPVT test scores for all children (-0.151 standard deviations, significant at the 5 percent level), which appears to be driven by girls' results (-0.144 standard deviations, significant at the 10 percent level). In contrast, the effects of market work are mostly small and always insignificant when using IVs. As hours of domestic work include taking care of smaller children, this could lead to slower language development for the children (mainly girls) that perform this chore.

Table 4b summarizes the results for the case of the Mathematics test score. The results provide weak evidence of a negative effect of additional hours of market or domestic work on mathematics skills for boys (and thus for all children). This could reflect low numeracy levels for children in Ethiopia at a young age. Looking closely at the IV results, an additional hour of domestic work lowers girls' mathematics test scores

by 0.128 standard deviations (significant at the 10 percent level), which is a relatively moderate effect.

In all the specifications, a higher initial level of human capital and a higher educational level of the child and the parents translate into an increase in the child test scores. Also, children residing in rural areas have a lower academic performance than children residing in urban areas, perhaps due to lower school quality.

5.2 Results for children aged 12 years – Younger Cohort

The analysis of the impact of domestic and market work for the younger cohort when they were 12 years old is summarized in Tables 5a-b.

Tables 5a-b include a series of statistics that test the validity of the instruments used in the analysis. In the case of boys, the results show evidence of valid and non-weak instruments. The p-value of the Hansen (overidentification) test is large (greater than 0.10), which mean that the instruments are valid. The F-statistic for market work is greater than 10 in all cases, therefore the instruments for this type of work are not weak; but the F-statistic for domestic work in ranges between 4.11 and 8.19, in which case the instruments for domestic work are weaker than those for market work. The results for girls fail the overidentification test at the 5 percent level, although not at the 1 percent level (see p-values for the Hansen test) for the vocabulary test score estimates. The F-statistic for market work is greater than 10, therefore the instruments for this type of work are not weak, but the F-statistic for domestic work ranges between 3.15 and 3.21, so that the instruments for domestic work are weak.

In addition, when analyzing the first stage for hours of domestic and market work, (Table A.2 of Appendix 1) the results suggest that some instruments work for both boys and girls, while others are gender-specific. The key determinants of domestic work are related to sibling composition, such as the proportion of younger sisters or brothers, while the key determinants of market work are those related to environmental shocks faced by the household in the past 4 years, such as death of livestock and drought.

When analyzing the effect on the scores for the two different tests (Tables 5a and 5b), the magnitude of the child work effect when using IVs becomes larger in most of the cases, perhaps as a result of correcting for attenuation bias. Table 5a shows that additional hours of market work have a negative and significant effect on vocabulary test scores. The IV results show that the effect for girls is -0.193 standard deviations (significant at the 5 percent level) and for boys is -0.370 standard deviations (significant at the 1 percent level). The effect of domestic work on the PPVT test score has different signs when using OLS and IVs, is not significant at the 10 percent level in all cases, and relatively small. When analyzing the effects of child work on the mathematics test scores, most of the effects when using IVs are insignificant, except for additional hours of market work for boys, which have a negative effect of -0.145 standard deviations (significant at the 10 percent level).

The IV results show that the negative effect of market work is larger for boys than for girls for both the PPVT and the Math test scores, although the differences are not statistically significant. In all the specifications, a higher initial level of human capital and a higher educational level of the parents translates into an increase in the child test scores. Children residing in rural areas have a lower academic performance than children residing in urban areas, maybe due to lower school quality. [34]

5.3 Results for children aged 12 years – Older Cohort

Tables 6a-b summarize the results for children of the older cohort who were 12 years old at the time of the Round 2 survey in 2006.

[34] Young Lives has school level data available for Round 4. When analyzing the differences between urban and rural schools, the data show that teachers of urban schools have more experience teaching (12.3 vs 7.4 years), more experience teaching in the grade they currently teach (6.8 vs. 3.7), and, on average have a higher level of education (47.4 percent): 46.5 percent of rural teachers hold a post-secondary diploma and 0.9 percent of the rural teachers hold a university degree, compared to 64.8 of urban teachers that have a high level of education: 51.6 percent hold a post-secondary diploma and 13.0 percent hold a university degree.

Tables 6a-b include a series of statistics that test the validity of the instruments used in the analysis. The p-value of the Hansen (overidentification) test is large (greater than 0.10) in most cases, which means that the instruments are valid. The exception to this general rule are the results for girls for the vocabulary test score estimates; they fail the overidentification test at the 5 percent level but not at the 1 percent level (see p-values for the Hansen test). The older cohort estimations present weaker IVs than the younger cohort one; a possible explanation is a smaller sample size (see F-statistic values).

Table A.3.a, in Appendix 1, shows the first stage regression results for domestic and market work. The results suggest that, for all children, a larger proportion of older brothers or sisters will decrease the amount of domestic work per child, but the father's illness increases the hours of domestic work performed by the children residing in a household that faced that shock. On the other hand, the determinants of market work are: a larger proportion of younger sisters and environmental shocks such as drought, flood, frost or death of livestock.

Similar to the findings for children of the younger cohort at the same age, the results provide weak evidence that market work has negative effects on vocabulary skills (PPVT), but provide no evidence of effects of child work on mathematics test scores.

As shown in Table 6a, the results for the effect of child work on vocabulary skills provide evidence of a negative and significant effect of additional hours of market work on PPVT scores. The coefficients are stable among specifications and the effects of market work are significant at the 10 percent level for girls and boys separately. An additional hour of market work has a larger effect on PPVT for girls than for boys (-0.373 vs. -0.241). Note that the results for girls have to be interpreted with caution considering that the instrumental variables fail the overidentification test. Table 6b shows that there are no significant effects of additional hours of domestic or market work on the average test score or mathematics skills; except for additional hours of domestic work for boys and girls combined, which have a positive and significant effect of 0.173 standard

deviations (significant at the 10 percent level). The evidence suggests that additional hours of domestic and market work could lead to higher mathematics test scores, when using the instrumental variables approach, but as mentioned before, the results are not significant at the 10 percent level.

The Young Lives study for the older cohort includes self-reported data on the number of hours allocated to different types of work, school, and leisure activities; thus, these additional data are used to test for measurement error. Table A.3.b summarizes results for the OLS estimations using self-reported data on domestic and market work. The results for PPVT scores confirm the negative relationship between both domestic and market work and vocabulary skills, but they are not significant.

5.4 Results for children aged 15 years – Older Cohort

The last group of children included in the analysis is the one that includes 15-year-old youth at the time of the survey; these are children that have already reached the age where school is not compulsory in Ethiopia.[35] Tables 7a-b summarize the findings for this sample. Although most of the effects are not significant at the 10 percent level, the results suggest that there is a negative effect of additional hours of domestic and market work on academic achievement.

Tables 7a-b report a series of statistics that test the validity of the instruments used in the analysis. The p-value of the Hansen (overidentification) test is large (greater than 0.10) in the different specifications, which means that the instruments are valid. The F-statistics show that the instruments are weak for boys, especially for the case of domestic work, but for girls, the instruments are not weak when using a threshold of 5 for the F-statistic.

[35] Data on marital status was not directly included in this survey. But some additional questions show that most likely, children surveyed in Round 4 were not married. Two questions related to migration show that just one child moved in the last three months because of marriage, and one question in relation to reasons for not attending school show that just two children were not attending school because of marriage.

The results of the first stage regressions estimating the determinants of domestic and market work are summarized in Table A.4.a of Appendix 1. The key determinants of domestic work for girls are a larger proportion of younger sisters, having an ill mother, and death of livestock. Similarly, the determinants of market work for boys include death of livestock and drought.

The results show that the relationship between hours of domestic work and the PPVT test score is negative and relatively small. For the case of girls, the effect of market work is large and significant (at the 1 percent level), an additional hour of market work lowers the PPVT test score by 0.323 standard deviations (Table 7a). The effects of child work on mathematics test scores are negative and significant when using the OLS approach, but the IV results are non-significant and in some cases the direction of the effect differs between OLS and IV estimations. As in all the other analyzed samples, the magnitude of the effect is larger when using an IV approach.

The estimations were also performed using self-reported data on time use, summarized in Table A.4.b. The effects are similar than those found using the adult reported data and are mainly not significant.

6. Conclusion

The statistical analysis confirms Orazem and Gunnarsson's (2004) statement in relation to correcting for endogeneity of child work by using instrumental variables. The estimated impacts of the different types of child work are more negative when using the instrumental variables approach, as shown in Figure 3 for the case of vocabulary test scores coefficients. In my estimates, the OLS specifications underestimated the effect of child work on school performance.

In the context of the Young Lives households in Ethiopia, the instrumental variables results presented in section 5 suggest that the negative effects of child work are mainly concentrated in vocabulary skills and there is weak evidence of effects of child

work on mathematics test scores. Both domestic and market work have negative effects on the vocabulary test scores for children at all ages, and the effects are larger for children aged 12 and 15.

Domestic work has statistically significant negative effects on vocabulary skills for the youngest and oldest girls in the Young Lives sample: -0.144 standard deviations for an additional hour of domestic work (significant at the 5 percent level) for 8-year-old girls, and -0.323 standard deviations for an additional hour of market work (significant at the 10 percent level) for 15-year-old girls. Market work has a large effect for 12-year-old boys and girls in both cohorts, with effects ranging from -0.193 to -0.373 standard deviations.

The direction of the effect of child work on the mathematics test scores was not as clear and statistically significant when compared to the effects on vocabulary skills. An additional hour of domestic work results in declines of 0.128 standard deviations (significant at the 10 percent level) for 8-year-old girls, and -0.145 standard deviations (significant at the 10 percent level) for 12-year-old boys from the younger cohort. The only positive and statistically significant effect in the analysis was found when pooling 12-year-old boys and girls of the older cohort: a 0.173 standard deviation increase for an additional hour of market work (significant at the 10 percent level). In this analysis, I included 36 different estimations, where 15 of them are statistically significant at least at the 10 percent level, and the evidence strongly suggest that the effect of child labor is generally negative; therefore, this could be a random significant effect.

One possible explanation for the relative magnitudes of the effects when comparing 8-year-old children to older children could be related to school enrollment. In Ethiopia, children start working at young ages, but they start attending school relatively late at age 8. Children aged 12 years old attend school, but are also performing different types of working activities in the household, which compete with time in school and time

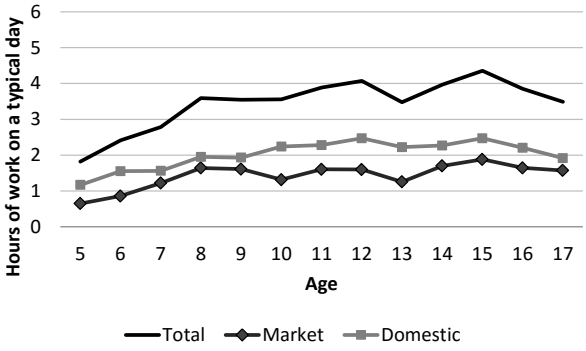
for studying. This result is consistent with Cockburn's (2002) findings which showed that test scores appeared to be lower for children with multiple work activities.

The results are also in line with the conclusions from Akabayashi and Psacharopoulos (1999), Heady (2003) and Orazem and Gunnarsson (2006); children engaged in market activities perform worse in school. This paper presents new evidence that domestic work also has negative effects on learning, especially in vocabulary skills. The results also present evidence of the rural-urban gap on test scores, especially for children aged 8 to 12, which could reflect the differences in the quality of education.

Even if the results show that child work has negative effects in student academic achievement, test scores are just one dimension of the child's development. Suggesting policies prohibiting work for children in their school years could also be harmful for their future. On one hand, the activities that children perform outside of school can prepare them for the economic and cultural environment of their communities, and one the other hand, some children work in order to be able to attend school. A longer-term analysis of the effects of child work in the Ethiopian context is needed to propose policies that could enhance both student academic achievement and the acquisition of additional skills that will be useful in the future.

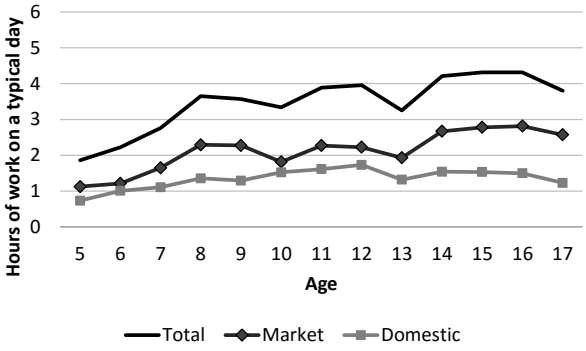
7. Figures

Figure 1a- All Children- Average number of hours worked in a typical day



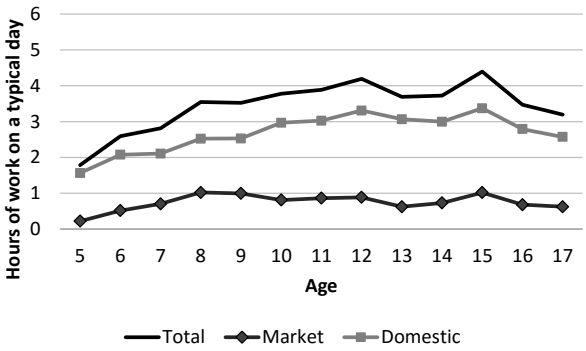
Source: Author's estimates using Young Lives, Round 4 (2013).

Figure 1b - Boys - Average number of hours worked in a typical day



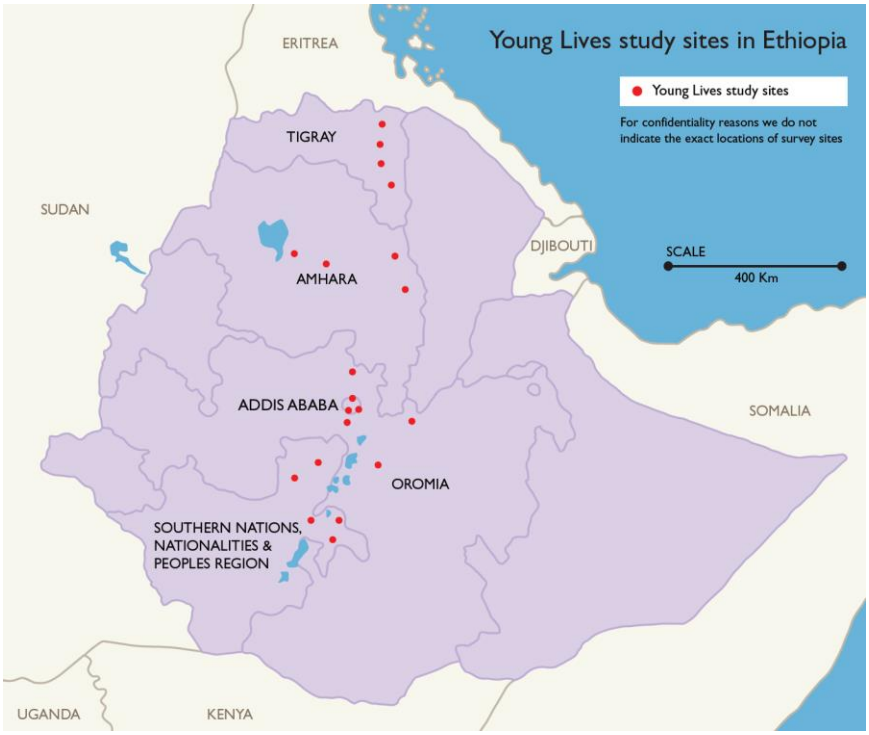
Source: Author's estimates using Young Lives, Round 4 (2013).

Figure 1c – Girls - Average number of hours worked in a typical day



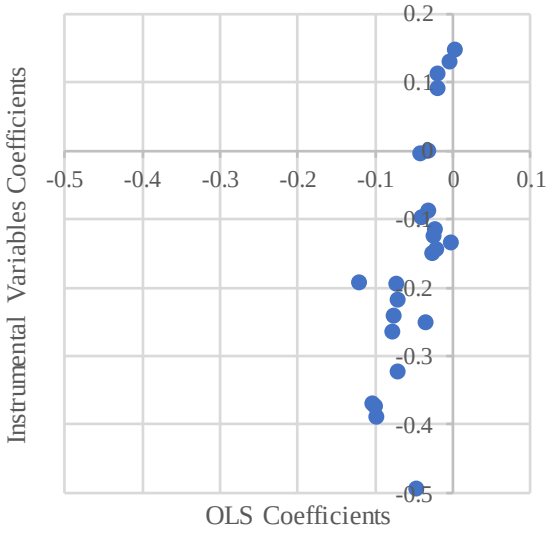
Source: Author's estimates using Young Lives, Round 4 (2013).

Figure 2 – Young Lives Study sites in Ethiopia



Source: Young Lives

Figure 3 OLS vs. IV child work coefficients for Vocabulary Test Scores



8. Tables

Table 1 – Young Lives Rounds and Cohorts

	Round 2 (2006)	Round 3 (2009)	Round 4 (2013)
Older Cohort			
Age	12	15	
Number of children in the survey	980	971	
Number of children in the PPVT analysis	782	826	
Number of children in the Math analysis	782	810	
Younger Cohort			
Age		8	12
Number of children in the survey		1,884	1,875
Number of children in the PPVT analysis		1,527	1,346
Number of children in the Math analysis		1,489	1,328

Table 2 – Child's First Language and PPVT Test Completion (Round 4)

	Number of children in the survey	Number of children NOT taking the PPVT test	Percentage of children that did not take the PPVT test
Afarigna	5		
Amarigna	804	4	0.5%
Guraghigna	93	2	2%
Hadiyigna	99	97	98%
Oromifa	302		
Sidamigna	94	91	97%
Siltigna	4		
Tigrigna	378	1	0.3%
Welayitegna	90	38	42%
Total	1869	233	12%

Table 3a – Round 3 (Children aged 8 years old) -Younger Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.87	0.34	0.83	0.37	0.80	0.40	0.81	0.40
PPVT Test score	84.87	45.39	70.35	37.84	61.67	31.24	74.90	40.29
Math Test score	7.37	5.39	5.73	4.65	4.90	4.03	6.05	4.97
Highest grade attained	2.31	1.21	2.12	1.26	2.05	1.30	2.05	1.29
Time in school (hours)*	2.25	3.34	0.78	2.08	0.27	1.19	1.02	2.41
Time studying at home (hours)*	0.30	0.58	0.10	0.40	0.02	0.15	0.15	0.49
Child Labor								
Works (total hours of work >= 1)	0.92	0.27	1.00	0.00	1.00	0.00	1.00	0.00
Total hours of work	3.61	2.47	5.19	1.85	5.97	1.88	5.19	1.97
Total hours of market work	1.40	2.10	2.30	2.29	4.44	1.54	0.96	1.62
Total hours of domestic work	2.21	1.80	2.89	1.95	1.53	1.40	4.23	1.38
Child's Characteristics								
Female	0.47	0.50	0.48	0.50	0.25	0.43	0.65	0.48
Male	0.53	0.50	0.52	0.50	0.75	0.43	0.35	0.48
Age in months	97.54	3.69	97.53	3.73	97.28	3.87	97.77	3.64
Parents' Characteristics								
Caregiver is one of the parents	0.93	0.25	0.95	0.22	0.97	0.18	0.94	0.23
Highest educational level of the parents (in years)	4.03	4.52	2.69	3.69	1.90	3.04	3.22	3.92
One parent absent	0.16	0.37	0.12	0.33	0.11	0.32	0.13	0.34
Both parents absent	0.01	0.10	0.01	0.10	0.01	0.08	0.01	0.08
Household Composition								
Number of household members	6.13	1.98	6.37	1.85	6.50	1.69	6.28	1.92
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.27	0.04	0.20	0.01	0.11	0.06	0.24
Household in 2nd lowest urban quintile	0.08	0.27	0.04	0.21	0.01	0.09	0.07	0.26
Household in the top 3 urban quintile	0.29	0.45	0.12	0.32	0.03	0.16	0.18	0.38
Household in the lowest rural quintile (reference)	0.09	0.29	0.13	0.33	0.15	0.36	0.11	0.32
Household in 2nd lowest rural quintile	0.10	0.29	0.15	0.36	0.23	0.42	0.10	0.30
Household in the top 3 rural quintile	0.36	0.48	0.52	0.50	0.57	0.50	0.48	0.50
Geography								
Addis Ababa (reference)	0.18	0.38	0.03	0.17	0.00	0.00	0.05	0.23
Amhara	0.25	0.43	0.29	0.45	0.33	0.47	0.28	0.45
Oromia	0.22	0.42	0.27	0.44	0.21	0.41	0.30	0.46
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.11	0.31	0.09	0.29	0.04	0.19	0.15	0.35
Tigray	0.25	0.43	0.32	0.47	0.42	0.50	0.22	0.42
Rural	0.55	0.50	0.80	0.40	0.95	0.21	0.69	0.46
Instruments								
Sibling Composition								
Number of older sisters	1.07	1.20	1.19	1.24	1.31	1.27	1.10	1.17
Number of younger sisters	1.13	1.29	1.23	1.32	1.32	1.33	1.19	1.32
Number of older brothers	0.49	0.67	0.64	0.72	0.67	0.71	0.60	0.70
Number of younger brothers	0.50	0.67	0.66	0.72	0.67	0.69	0.70	0.73
Household Shocks								
Mom Ill past 4 years	0.21	0.41	0.22	0.42	0.26	0.44	0.22	0.42
Dad Ill past 4 years	0.13	0.34	0.16	0.36	0.19	0.40	0.14	0.35
Other Ill past 4 years	0.23	0.42	0.26	0.44	0.27	0.44	0.26	0.44
Death in the Household past 4 years	0.08	0.27	0.05	0.23	0.06	0.24	0.05	0.23
New Household Member past 4 years	0.15	0.36	0.20	0.40	0.25	0.43	0.19	0.39
Environmental Shocks								
Drought past 4 years	0.31	0.46	0.45	0.50	0.61	0.49	0.37	0.48
Flood past 4 years	0.11	0.32	0.17	0.38	0.20	0.40	0.17	0.38
Frost past 4 years	0.11	0.32	0.17	0.37	0.27	0.45	0.11	0.32
Death of Livestock past 4 years	0.30	0.46	0.41	0.49	0.51	0.50	0.34	0.47
Observations	1,208		729		332		420	

* For the time in school and time studying variables, 835 out of the 1,208 children reposponded these questions.

Table 3b – Round 4 (Children aged 12 years old) -Younger Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.97	0.16	0.96	0.19	0.94	0.24	0.97	0.18
PPVT Test score	39.34	8.15	37.04	8.08	34.67	7.70	38.27	8.17
Math Test score	10.84	5.94	9.47	5.47	8.53	4.81	9.95	5.70
Highest grade attained	4.82	1.67	4.56	1.75	4.34	1.95	4.60	1.70
Time in school (hours)	5.88	1.56	5.49	1.37	5.25	1.53	5.58	1.35
Time studying at home (hours)	1.58	0.92	1.46	0.88	1.32	0.88	1.53	0.85
Child Labor								
Works (total hours of work >= 1)	0.94	0.24	1.00	0.00	1.00	0.00	1.00	0.00
Total hours of work	3.76	2.17	4.87	1.59	5.63	1.68	4.78	1.60
Total hours of market work	1.55	2.05	2.20	2.15	4.15	1.52	0.89	1.50
Total hours of domestic work	2.21	1.61	2.67	1.66	1.48	1.21	3.89	1.02
Child's Characteristics								
Female	0.47	0.50	0.49	0.50	0.25	0.44	0.70	0.46
Male	0.53	0.50	0.51	0.50	0.75	0.44	0.30	0.46
Age in months	145.47	3.89	145.34	3.92	145.23	3.95	145.54	3.85
Parents' Characteristics								
Caregiver is one of the parents	0.93	0.25	0.95	0.21	0.97	0.18	0.94	0.23
Highest educational level of the parents (in years)	4.60	4.78	3.46	4.17	2.31	3.32	4.23	4.45
One parent absent	0.22	0.42	0.17	0.38	0.13	0.34	0.18	0.39
Both parents absent	0.05	0.22	0.04	0.19	0.03	0.16	0.04	0.20
Household Composition								
Number of household members	5.82	1.90	6.05	1.84	6.26	1.74	5.95	1.91
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.28	0.07	0.25	0.03	0.16	0.10	0.30
Household in 2nd lowest urban quintile	0.09	0.29	0.05	0.23	0.03	0.16	0.08	0.26
Household in the top 3 urban quintile	0.29	0.45	0.17	0.37	0.06	0.24	0.22	0.42
Household in the lowest rural quintile (reference)	0.06	0.23	0.08	0.27	0.10	0.30	0.07	0.25
Household in 2nd lowest rural quintile	0.09	0.29	0.13	0.33	0.18	0.38	0.08	0.28
Household in the top 3 rural quintile	0.39	0.49	0.51	0.50	0.60	0.49	0.45	0.50
Geography								
Addis Ababa (reference)	0.18	0.38	0.04	0.19	0.00	0.00	0.07	0.25
Amhara	0.24	0.43	0.28	0.45	0.38	0.49	0.22	0.41
Oromia	0.23	0.42	0.28	0.45	0.20	0.40	0.32	0.47
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.11	0.31	0.11	0.31	0.03	0.16	0.17	0.38
Tigray	0.25	0.43	0.30	0.46	0.39	0.49	0.23	0.42
Other region	0.00	0.04	0.00	0.03	0.00	0.05	0.00	0.00
Rural	0.54	0.50	0.71	0.45	0.89	0.32	0.60	0.49
Instruments								
Sibling Composition								
Number of older sisters	1.08	1.20	1.18	1.24	1.34	1.28	1.04	1.18
Number of younger sisters	1.15	1.29	1.24	1.31	1.32	1.29	1.15	1.28
Number of older brothers	0.68	0.86	0.83	0.91	0.93	0.95	0.82	0.89
Number of younger brothers	0.70	0.85	0.82	0.89	0.85	0.86	0.83	0.91
Household Shocks								
Mom Ill past 4 years	0.10	0.31	0.10	0.29	0.08	0.28	0.11	0.31
Dad Ill past 4 years	0.07	0.26	0.07	0.26	0.07	0.26	0.08	0.27
Other Ill past 4 years	0.12	0.32	0.10	0.30	0.09	0.29	0.12	0.32
Death in the Household past 4 years	0.06	0.23	0.05	0.22	0.04	0.20	0.05	0.21
New Household Member past 4 years	0.03	0.16	0.03	0.16	0.03	0.16	0.04	0.19
Environmental Shocks								
Drought past 4 years	0.15	0.36	0.21	0.41	0.31	0.46	0.14	0.35
Flood past 4 years	0.07	0.26	0.10	0.30	0.13	0.33	0.08	0.27
Frost past 4 years	0.14	0.34	0.19	0.39	0.30	0.46	0.13	0.34
Death of Livestock past 4 years	0.18	0.39	0.24	0.43	0.31	0.46	0.20	0.40
Observations	1,208		838		383		465	

Table 3c – Round 2 (Children aged 12 years old) -Older Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.98	0.14	0.98	0.15	0.96	0.20	0.98	0.14
PPVT Test score	76.99	25.96	72.68	24.88	67.67	23.96	73.29	25.23
Math Test score	5.03	2.39	4.83	2.40	4.76	2.52	4.76	2.41
Time in school (hours)	5.64	1.54	5.42	1.47	5.21	1.60	5.41	1.45
Time studying at home (hours)	1.78	1.01	1.68	0.98	1.56	0.97	1.71	0.95
Child Labor								
Works (total hours of work >= 1)	0.97	0.17	1.00	0.00	1.00	0.00	1.00	0.00
Total hours of work	4.10	2.03	4.97	1.51	5.54	1.55	5.04	1.54
Total hours of market work	1.42	1.83	1.86	1.90	4.00	1.23	0.90	1.29
Total hours of domestic work	2.69	1.79	3.11	1.83	1.54	1.32	4.14	1.28
Child's Characteristics								
Female	0.50	0.50	0.52	0.50	0.22	0.42	0.69	0.46
Male	0.50	0.50	0.48	0.50	0.78	0.42	0.31	0.46
Age in months	145.19	3.73	145.28	3.77	145.15	3.76	145.33	3.81
Parents' Characteristics								
Caregiver is one of the parents	0.89	0.32	0.90	0.30	0.91	0.28	0.89	0.32
Highest educational level of the parents (in years)	3.43	4.16	2.94	3.85	1.99	2.97	3.28	3.99
One parent absent	0.14	0.35	0.12	0.33	0.10	0.31	0.13	0.34
Both parents absent	0.02	0.15	0.02	0.13	0.02	0.15	0.01	0.10
Household Composition								
Number of household members	6.59	2.04	6.73	2.00	7.03	1.86	6.51	2.03
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.27	0.07	0.26	0.02	0.15	0.09	0.29
Household in 2nd lowest urban quintile	0.08	0.27	0.06	0.23	0.01	0.10	0.07	0.26
Household in the top 3 urban quintile	0.25	0.43	0.16	0.37	0.08	0.27	0.19	0.39
Household in the lowest rural quintile (reference)	0.11	0.31	0.13	0.34	0.13	0.33	0.13	0.33
Household in 2nd lowest rural quintile	0.12	0.32	0.14	0.35	0.14	0.35	0.14	0.35
Household in the top 3 rural quintile	0.36	0.48	0.43	0.50	0.62	0.49	0.37	0.48
Geography								
Addis Ababa (reference)	0.16	0.37	0.09	0.28	0.03	0.17	0.11	0.32
Amhara	0.18	0.38	0.21	0.41	0.21	0.41	0.22	0.41
Oromia	0.21	0.41	0.24	0.42	0.21	0.41	0.25	0.43
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.24	0.42	0.23	0.42	0.20	0.40	0.24	0.43
Tigray	0.21	0.41	0.24	0.43	0.34	0.48	0.18	0.38
Rural	0.59	0.49	0.71	0.45	0.89	0.31	0.64	0.48
Instruments								
Sibling Composition								
Number of older sisters	1.08	1.18	1.07	1.16	1.29	1.21	0.91	1.07
Number of younger sisters	0.81	0.93	0.90	0.97	0.96	1.00	0.85	0.89
Number of older brothers	1.10	1.18	1.09	1.18	1.20	1.18	1.04	1.16
Number of younger brothers	0.84	0.95	0.94	0.99	0.97	0.97	0.93	0.98
Household Shocks								
Mom Ill past 4 years	0.18	0.39	0.18	0.38	0.17	0.37	0.17	0.38
Dad Ill past 4 years	0.15	0.36	0.16	0.36	0.12	0.33	0.16	0.37
Other Ill past 4 years	0.19	0.39	0.19	0.39	0.15	0.35	0.20	0.40
Death in the Household past 4 years	0.13	0.33	0.13	0.34	0.12	0.33	0.15	0.36
New Household Member past 4 years	0.17	0.37	0.19	0.39	0.20	0.40	0.19	0.39
Environmental Shocks								
Drought past 4 years	0.30	0.46	0.36	0.48	0.47	0.50	0.32	0.47
Flood past 4 years	0.12	0.33	0.15	0.35	0.18	0.39	0.14	0.35
Frost past 4 years	0.07	0.26	0.09	0.28	0.13	0.33	0.06	0.24
Death of Livestock past 4 years	0.27	0.44	0.32	0.47	0.36	0.48	0.30	0.46
Observations	782		587		211		384	

Table 3d – Round 3 (Children aged 15 years old) -Older Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.92	0.27	0.90	0.29	0.79	0.41	0.91	0.29
PPVT Test score	152.03	35.66	148.10	36.60	140.56	37.57	149.32	36.48
Math Test score	5.92	4.87	5.44	4.68	5.17	4.48	5.47	4.79
Time in school (hours)	5.69	2.08	5.40	2.05	4.51	2.46	5.49	2.02
Time studying at home (hours)	1.95	1.19	1.86	1.17	1.49	1.23	1.87	1.13
Child Labor								
Works (total hours of work >= 1)	0.99	0.12						
Total hours of work	4.76	2.47	5.44	2.15	6.76	2.55	5.43	2.17
Total hours of market work	1.61	2.34	1.92	2.45	4.79	1.98	1.03	1.91
Total hours of domestic work	3.15	1.95	3.52	1.93	1.96	1.63	4.40	1.40
Child's Characteristics								
Female	0.50	0.50	0.52	0.50	0.19	0.39	0.68	0.47
Male	0.50	0.50	0.48	0.50	0.81	0.39	0.32	0.47
Age in months	180.30	3.49	180.18	3.50	180.37	3.42	180.15	3.47
Parents' Characteristics								
Caregiver is one of the parents	0.90	0.31	0.91	0.29	0.93	0.25	0.90	0.30
Highest educational level of the parents (in years)	3.36	4.12	3.01	3.91	2.28	3.35	3.20	4.03
One parent absent	0.19	0.39	0.16	0.37	0.18	0.39	0.15	0.36
Both parents absent	0.02	0.13	0.01	0.11	0.01	0.12	0.01	0.12
Household Composition								
Number of household members	6.48	2.03	6.59	2.00	6.78	1.91	6.49	2.02
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.28	0.06	0.24	0.04	0.19	0.07	0.26
Household in 2nd lowest urban quintile	0.08	0.27	0.07	0.25	0.04	0.19	0.07	0.26
Household in the top 3 urban quintile	0.24	0.43	0.19	0.39	0.10	0.30	0.21	0.41
Household in the lowest rural quintile (reference)	0.11	0.31	0.12	0.32	0.14	0.35	0.12	0.32
Household in 2nd lowest rural quintile	0.12	0.33	0.14	0.35	0.15	0.36	0.14	0.35
Household in the top 3 rural quintile	0.36	0.48	0.42	0.49	0.54	0.50	0.38	0.49
Geography								
Addis Ababa (reference)	0.16	0.37	0.07	0.26	0.03	0.16	0.08	0.28
Amhara	0.18	0.38	0.19	0.39	0.21	0.41	0.18	0.39
Oromia	0.21	0.41	0.24	0.43	0.28	0.45	0.23	0.42
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.24	0.43	0.27	0.44	0.19	0.39	0.29	0.46
Tigray	0.21	0.41	0.24	0.42	0.29	0.46	0.21	0.41
Rural	0.59	0.49	0.68	0.47	0.83	0.38	0.64	0.48
Instruments								
Sibling Composition								
Number of older sisters	1.19	1.21	1.22	1.18	1.30	1.23	1.18	1.15
Number of younger sisters	0.72	0.88	0.78	0.91	0.93	1.00	0.73	0.86
Number of older brothers	1.24	1.24	1.25	1.26	1.36	1.21	1.19	1.26
Number of younger brothers	0.71	0.85	0.78	0.87	0.89	0.96	0.75	0.84
Household Shocks								
Mom Ill past 4 years	0.22	0.41	0.23	0.42	0.22	0.41	0.24	0.43
Dad Ill past 4 years	0.15	0.36	0.17	0.37	0.14	0.35	0.17	0.38
Other Ill past 4 years	0.24	0.43	0.25	0.43	0.23	0.42	0.27	0.44
Death in the Household past 4 years	0.10	0.30	0.09	0.29	0.11	0.31	0.08	0.27
New Household Member past 4 years	0.08	0.27	0.09	0.28	0.09	0.29	0.09	0.29
Environmental Shocks								
Drought past 4 years	0.37	0.48	0.42	0.49	0.51	0.50	0.41	0.49
Flood past 4 years	0.12	0.33	0.14	0.35	0.19	0.39	0.13	0.34
Frost past 4 years	0.11	0.31	0.13	0.33	0.16	0.37	0.13	0.34
Death of Livestock past 4 years	0.29	0.46	0.34	0.48	0.39	0.49	0.33	0.47
Observations	782		645		221		472	

Table 4a – PPVT Test Score for children aged 8 years old (Round 3, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.027*	-0.151**	-0.023	-0.144*	-0.026	-0.126
	(0.014)	*(0.069)*	*(0.014)*	*(0.074)*	*(0.021)*	*(0.095)*
Total hours of market work	-0.033**	-0.001	0.001	0.146	-0.043**	-0.005
	(0.011)	*(0.083)*	*(0.023)*	*(0.133)*	*(0.015)*	*(0.055)*
Cognitive Test Score Round 2	0.151***	0.151***	0.121***	0.149***	0.178***	0.217***
	-0.020	*-0.020*	*-0.028*	*-0.033*	*-0.023*	*-0.022*
Highest educational level of the parents	0.024**	0.023***	0.018	0.017	0.030***	0.029***
	(0.008)	*(0.007)*	*(0.011)*	*(0.011)*	*(0.007)*	*(0.008)*
Rural	-0.306	-0.340	-0.326	-0.598	-0.313	-0.405
	(0.340)	*(0.439)*	*(0.349)*	*(0.374)*	*(0.342)*	*(0.344)*
Constant	-4.718***	-4.982***	-4.379***	0.360*	-4.746***	0.273
	(0.691)	*(0.661)*	*(1.090)*	*(0.205)*	*(0.844)*	*(0.251)*
Observations	1,527	1,527	708	708	819	819
Hansen J-Stat		20.18		15.58		9.81
p-value		0.06		0.21		0.63
First Stage F-Stat - Domestic Work		19.91		19.18		6.32
First Stage F-Stat - Market Work		64.88		11.74		56.31
R-squared	0.469	0.417	0.44	0.303	0.512	0.448

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4b – Mathematics Test Score for children aged 8 years old (Round 3, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.031**	-0.057	-0.035***	-0.128*	-0.028	0.017
	(0.012)	*(0.054)*	*(0.012)*	*(0.065)*	*(0.024)*	*(0.109)*
Total hours of market work	-0.025	-0.006	-0.013	0.085	-0.027	-0.082
	(0.015)	*(0.071)*	*(0.027)*	*(0.115)*	*(0.017)*	*(0.085)*
Cognitive Test Score Round 2	0.094***	0.096***	0.105**	0.126**	0.074**	0.093***
	-0.025	*-0.025*	*-0.047*	*-0.049*	*-0.028*	*-0.029*
Highest educational level of the parents	0.026***	0.026***	0.033***	0.032***	0.018*	0.016
	(0.006)	*(0.006)*	*(0.009)*	*(0.009)*	*(0.010)*	*(0.010)*
Rural	-0.945***	-0.985***	-1.145***	-1.317***	-0.765***	-0.582*
	(0.208)	*(0.310)*	*(0.240)*	*(0.320)*	*(0.230)*	*(0.305)*
Constant	-1.561**	-1.608**	-1.467*	0.993***	-1.696**	0.639***
	(0.689)	*(0.650)*	*(0.832)*	*(0.170)*	*(0.795)*	*(0.175)*
Observations	1,489	1,489	690	690	799	799
Hansen J-Stat		19.72		10.66		21.97
p-value		0.07		0.56		0.04
First Stage F-Stat - Domestic Work		21.64		20.28		6.69
First Stage F-Stat - Market Work		124.10		19.46		58.19
R-squared	0.472	0.47	0.479	0.41	0.495	0.47

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5a – PPVT Test Score for children aged 12 years old (Round 4, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.020	0.090	-0.021	0.111	-0.005	0.130
	(0.023)	*(0.129)*	*(0.028)*	*(0.140)*	*(0.031)*	*(0.128)*
Total hours of market work	-0.100***	-0.390***	-0.121***	-0.193**	-0.104***	-0.370***
	(0.022)	*(0.083)*	*(0.026)*	*(0.091)*	*(0.025)*	*(0.105)*
CDA Score Round 2	0.142***	0.120***	0.107***	0.113***	0.175***	0.149***
	(0.0260)	*(0.0400)*	*(0.0310)*	*(0.0330)*	*(0.0350)*	*(0.0450)*
Highest educational level of the parents	0.021***	0.009**	0.024***	0.021***	0.020***	0.007
	(0.003)	*(0.005)*	*(0.006)*	*(0.007)*	*(0.005)*	*(0.009)*
Rural	-1.078***	-0.434*	-1.118***	-1.202***	-0.954**	0.013
	(0.307)	*(0.250)*	*(0.288)*	*(0.302)*	*(0.356)*	*(0.473)*
Constant	-1.155	-0.367	-0.492	0.156	-1.511	-1.537
	(0.950)	*(1.106)*	*(0.934)*	*(1.068)*	*(1.166)*	*(1.489)*
Observations	1,346	1,346	628	628	718	718
Hansen J-Stat		12.34		20.03		10.01
p-value		0.34		0.05		0.53
First Stage F-Stat - Domestic Work		5.05		3.15		8.19
First Stage F-Stat - Market Work		580.70		83.44		65.21
R-squared	0.556	0.239	0.574	0.512	0.56	0.301

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5b – Mathematics Test Score for children aged 12 years old (Round 4, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.037	0.057	-0.051*	-0.072	-0.007	0.007
	(0.022)	*(0.118)*	*(0.027)*	*(0.136)*	*(0.026)*	*(0.120)*
Total hours of market work	-0.056***	-0.09	-0.044*	-0.009	-0.071***	-0.145*
	(0.015)	*(0.082)*	*(0.024)*	*(0.116)*	*(0.022)*	*(0.086)*
CDA Score Round 2	0.115***	0.115***	0.104*	0.105**	0.127**	0.124***
	(0.0330)	*(0.0340)*	*(0.0540)*	*(0.0530)*	*(0.0470)*	*(0.0420)*
Highest educational level of the parents	0.036***	0.035***	0.038***	0.038***	0.034***	0.030***
	(0.006)	*(0.007)*	*(0.011)*	*(0.010)*	*(0.008)*	*(0.009)*
Rural	-0.721***	-0.652**	-0.774***	-0.798***	-0.644*	-0.444
	(0.214)	*(0.276)*	*(0.192)*	*(0.276)*	*(0.356)*	*(0.397)*
Constant	-1.065	-0.867	-0.587	-0.714	-1.541	-1.447
	(0.977)	*(1.068)*	*(1.633)*	*(1.616)*	*(1.374)*	*(1.336)*
Observations	1,328	1,328	622	622	706	706
Hansen J-Stat		6.61		16.74		13.70
p-value		0.83		0.12		0.25
First Stage F-Stat - Domestic Work		3.66		3.21		4.11
First Stage F-Stat - Market Work		98.25		46.85		52.69
R-squared	0.331	0.309	0.36	0.356	0.332	0.318

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6a – PPVT Test Score for children aged 12 years old (Round 2, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.041**	-0.098	-0.024	-0.115	-0.073*	-0.196
	(0.020)	*(0.111)*	*(0.023)*	*(0.100)*	*(0.035)*	*(0.213)*
Total hours of market work	-0.079***	-0.265	-0.101***	-0.373*	-0.077**	-0.241*
	(0.025)	*(0.192)*	*(0.029)*	*(0.208)*	*(0.032)*	*(0.135)*
Highest educational level of the parents	0.023**	0.020*	0.017	0.01	0.027*	0.03
	(0.009)	*(0.010)*	*(0.014)*	*(0.014)*	*(0.014)*	*(0.021)*
Rural	-0.947***	-0.642	-1.228***	-0.833*	-0.685**	-0.295
	(0.230)	*(0.425)*	*(0.366)*	*(0.442)*	*(0.290)*	*(0.437)*
Constant	-3.091***	-3.466***	-1.486	-1.874	-4.406**	-4.584**
	(0.956)	*(1.065)*	*(1.535)*	*(1.773)*	*(1.709)*	*(1.830)*
Observations	782	781	391	391	391	390
Hansen J-Stat		11.47		24.28		10.80
p-value		0.49		0.02		0.55
First Stage F-Stat - Domestic Work		8.62		6.44		5.66
First Stage F-Stat - Market Work		9.47		4.75		6.64
R-squared	0.391	0.326	0.493	0.394	0.374	0.32

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6b – Mathematics Test Score for children aged 12 years old (Round 2, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	0.003	0.173*	0.021	0.099	-0.024	0.121
	(0.024)	*(0.099)*	*(0.024)*	*(0.124)*	*(0.039)*	*(0.184)*
Total hours of market work	-0.019	0.071	0.02	0.28	-0.03	0.048
	(0.025)	*(0.159)*	*(0.040)*	*(0.233)*	*(0.025)*	*(0.151)*
Highest educational level of the parents	0.030***	0.029***	0.028**	0.035***	0.035**	0.028
	(0.008)	*(0.010)*	*(0.010)*	*(0.012)*	*(0.015)*	*(0.019)*
Rural	-0.776***	-1.108**	-0.982**	-1.341***	-0.470**	-0.716
	(0.262)	*(0.462)*	*(0.404)*	*(0.486)*	*(0.211)*	*(0.449)*
Constant	-1.518*	-1.449*	1.123	1.492	-3.808**	-3.980**
	(0.814)	*(0.771)*	*(1.782)*	*(1.802)*	*(1.508)*	*(1.625)*
Observations	782	781	391	391	391	390
Hansen J-Stat		11.56		10.58		11.09
p-value		0.48		0.57		0.52
First Stage F-Stat - Domestic Work		8.62		6.44		5.66
First Stage F-Stat - Market Work		9.47		4.75		6.64
R-squared	0.225	0.159	0.301	0.21	0.222	0.181

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7a – PPVT Test Score for children aged 15 years old (Round 3, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.036**	-0.252	-0.072*	-0.218	-0.004	-0.134
	(0.016)	*(0.170)*	*(0.037)*	*(0.157)*	*(0.025)*	*(0.165)*
Total hours of market work	-0.048***	-0.494*	-0.072*	-0.323***	-0.032*	-0.088
	(0.014)	*(0.283)*	*(0.037)*	*(0.112)*	*(0.017)*	*(0.098)*
PPVT Test Score Round 2	0.234***	0.159*	0.218***	0.187**	0.233***	0.197***
	(0.045)	*(0.081)*	*(0.062)*	*(0.076)*	*(0.061)*	*(0.052)*
Highest educational levelof the parents	0.016**	0.007	0.012	0.003	0.015	0.015
	(0.007)	*(0.008)*	*(0.010)*	*(0.012)*	*(0.011)*	*(0.011)*
Rural	-0.859***	0.342	-0.795***	-0.153	-0.944***	-0.717***
	(0.162)	*(0.733)*	*(0.268)*	*(0.399)*	*(0.121)*	*(0.244)*
Constant	0.887	-2.692	4.321**	3.864**	-2.248	-3.333
	(1.194)	*(3.006)*	*(1.994)*	*(1.896)*	*(2.123)*	*(2.178)*
Observations	826	826	405	405	421	421
Hansen J-Stat		4.09		15.92		6.27
p-value		0.94		0.10		0.79
First Stage F-Stat - Domestic Work		6.45		8.12		3.90
First Stage F-Stat - Market Work		3.17		6.24		4.30
R-squared	0.431		0.449	0.273	0.472	0.435

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7b – Mathematics Test Score for children aged 15 years old (Round 3, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.005	-0.164	-0.043*	-0.184	0.035	-0.023
	(0.017)	*(0.124)*	*(0.023)*	*(0.140)*	*(0.038)*	*(0.232)*
Total hours of market work	-0.036***	-0.254	-0.029*	0.054	-0.050**	-0.205
	(0.012)	*(0.283)*	*(0.014)*	*(0.153)*	*(0.023)*	*(0.170)*
Math Test Score Round 2	0.448***	0.394***	0.403***	0.400***	0.465***	0.432***
	(0.050)	*(0.073)*	*(0.044)*	*(0.058)*	*(0.065)*	*(0.076)*
Highest educational levelof the parents	0.008	0.002	0.008	0.005	0.007	0.003
	(0.008)	*(0.008)*	*(0.013)*	*(0.014)*	*(0.010)*	*(0.008)*
Rural	0.025	0.652	-0.205	-0.201	0.235	0.696
	(0.124)	*(0.718)*	*(0.195)*	*(0.483)*	*(0.261)*	*(0.615)*
Constant	-1.768	-3.153	-0.028	0.608	-3.929	-6.224*
	(1.547)	*(2.477)*	*(2.363)*	*(2.557)*	*(2.601)*	*(3.535)*
Observations	810	810	408	408	402	402
Hansen J-Stat		5.59		3.37		9.76
p-value		0.85		0.97		0.46
First Stage F-Stat - Domestic Work		5.90		6.04		2.48
First Stage F-Stat - Market Work		3.79		5.47		7.40
R-squared	0.412	0.229	0.457	0.364	0.416	0.332

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Appendix 1

Table A.1 – First Stage Estimations for Children Aged 8 Years Old

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Older Sisters	-0.815***	-1.447***	-0.365	-0.801***	-0.369**	-1.162***
	(0.217)	*(0.411)*	*(0.240)*	*(0.198)*	*(0.170)*	*(0.294)*
Proportion of Younger Sisters	0.507	0.601	0.321	-0.222	0.142	-0.597*
	(0.393)	*(0.389)*	*(0.400)*	*(0.280)*	*(0.330)*	*(0.338)*
Proportion of Older Brothers	-0.922***	-1.253***	-0.456*	-0.279	-0.458	-0.279
	(0.225)	*(0.333)*	*(0.222)*	*(0.282)*	*(0.343)*	*(0.362)*
Proportion of Younger Brothers	0.600**	0.340	0.695**	-0.381*	-0.426*	-0.242
	(0.234)	*(0.382)*	*(0.284)*	*(0.186)*	*(0.234)*	*(0.318)*
Mom Ill past 4 years	-0.032	-0.053	0.080	0.225	0.171	0.119
	(0.157)	*(0.277)*	*(0.130)*	*(0.198)*	*(0.223)*	*(0.254)*
Dad Ill past 4 years	0.036	-0.103	0.099	0.321**	0.278**	0.413
	(0.172)	*(0.246)*	*(0.186)*	*(0.139)*	*(0.131)*	*(0.248)*
Other Ill past 4 years	0.243*	0.336*	0.168	-0.115	-0.067	-0.141
	(0.126)	*(0.177)*	*(0.175)*	*(0.143)*	*(0.134)*	*(0.205)*
Death in the Household past 4 years	-0.370*	-0.374	-0.297	-0.071	0.055	-0.270
	(0.187)	*(0.237)*	*(0.194)*	*(0.191)*	*(0.192)*	*(0.373)*
New Household Member past 4 years	0.189	0.676*	-0.014	0.562***	0.067	0.766**
	(0.200)	*(0.341)*	*(0.229)*	*(0.166)*	*(0.204)*	*(0.304)*
Drought past 4 years	0.076	0.302	-0.154	1.235***	0.922***	1.565***
	(0.184)	*(0.215)*	*(0.215)*	*(0.302)*	*(0.262)*	*(0.388)*
Flood past 4 years	0.624***	0.580*	0.613**	0.109	-0.277	0.461
	(0.184)	*(0.306)*	*(0.230)*	*(0.268)*	*(0.245)*	*(0.269)*
Frost past 4 years	-0.231	-0.322	-0.055	0.743**	1.058***	0.460
	(0.239)	*(0.221)*	*(0.242)*	*(0.271)*	*(0.218)*	*(0.406)*
Death of Livestock past 4 years	0.157	0.474*	-0.108	0.857***	0.340**	1.253***
	(0.161)	*(0.256)*	*(0.173)*	*(0.184)*	*(0.134)*	*(0.309)*
Constant	2.121***	2.648***	1.633***	0.690**	0.378	1.024***
	(0.192)	*(0.284)*	*(0.173)*	*(0.278)*	*(0.247)*	*(0.346)*
Observations	1,208	563	645	1,208	563	645
R-squared	0.064	0.128	0.050	0.235	0.219	0.309
F-test	15.53	35.53	10.86	198.9	119.4	58.42

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.2 – First Stage Estimations for Children Aged 12 Years Old (Younger Cohort Round 4)

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Older Sisters	-0.730**	-1.243**	-0.597*	-1.266***	-0.680***	-1.558**
	(0.321)	*(0.443)*	*(0.317)*	*(0.343)*	*(0.208)*	*(0.598)*
Proportion of Younger Sisters	0.345	0.033	0.654**	-0.910***	-0.200	-1.573***
	(0.223)	*(0.414)*	*(0.282)*	*(0.257)*	*(0.312)*	*(0.382)*
Proportion of Older Brothers	-0.838***	-0.484	-0.629***	-0.926***	-0.692*	-1.614***
	(0.212)	*(0.369)*	*(0.189)*	*(0.299)*	*(0.356)*	*(0.458)*
Proportion of Younger Brothers	0.054	-0.230	0.242	-0.643**	-0.185	-1.086**
	(0.268)	*(0.370)*	*(0.231)*	*(0.289)*	*(0.312)*	*(0.516)*
Mom Ill past 4 years	0.137	0.087	-0.044	-0.365*	-0.005	-0.525**
	(0.199)	*(0.206)*	*(0.198)*	*(0.183)*	*(0.148)*	*(0.244)*
Dad Ill past 4 years	0.045	-0.054	0.044	0.106	-0.191	0.439
	(0.267)	*(0.268)*	*(0.295)*	*(0.359)*	*(0.176)*	*(0.455)*
Other Ill past 4 years	0.008	-0.111	0.342	-0.360**	-0.202	-0.691**
	(0.207)	*(0.247)*	*(0.215)*	*(0.171)*	*(0.174)*	*(0.248)*
Death in the Household past 4 years	-0.328*	-0.407	-0.142	-0.185	0.159	-0.549*
	(0.170)	*(0.300)*	*(0.222)*	*(0.199)*	*(0.250)*	*(0.279)*
New Household Member past 4 years	0.277	0.193	0.241	-0.408	-0.047	-0.687*
	(0.289)	*(0.410)*	*(0.562)*	*(0.239)*	*(0.202)*	*(0.342)*
Drought past 4 years	-0.173	0.130	-0.278*	1.087***	0.544**	1.391**
	(0.238)	*(0.292)*	*(0.159)*	*(0.318)*	*(0.233)*	*(0.603)*
Flood past 4 years	0.315	0.227	0.136	0.380**	0.498**	0.471
	(0.209)	*(0.214)*	*(0.206)*	*(0.157)*	*(0.216)*	*(0.362)*
Frost past 4 years	-0.242	-0.170	-0.293**	1.174***	1.254***	1.085**
	(0.170)	*(0.278)*	*(0.120)*	*(0.237)*	*(0.276)*	*(0.392)*
Death of Livestock past 4 years	0.158	0.422	-0.235	0.758***	0.248	1.392***
	(0.244)	*(0.269)*	*(0.142)*	*(0.203)*	*(0.175)*	*(0.225)*
Constant	2.320***	3.036***	1.678***	1.479***	0.731***	2.174***
	(0.195)	*(0.273)*	*(0.154)*	*(0.318)*	*(0.224)*	*(0.445)*
Observations	1,208	571	637	1,208	571	637
R-squared	0.026	0.046	0.056	0.212	0.200	0.302
F-test	3.319	3.176	10.66	128.5	55.33	49.27

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.3.a – First Stage Estimations for Children Aged 12 Years Old (Older Cohort Round 2)

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Older Sisters	-0.683*	-0.441	-0.185	0.675	-0.065	0.942
	(0.372)	*(0.389)*	*(0.497)*	*(0.407)*	*(0.339)*	*(0.626)*
Proportion of Younger Sisters	0.130	0.880	0.098	0.587**	0.246	0.633
	(0.459)	*(0.653)*	*(0.549)*	*(0.272)*	*(0.248)*	*(0.605)*
Proportion of Older Brothers	-0.706**	-0.510	-0.338	0.238	-0.233	0.431
	(0.294)	*(0.370)*	*(0.518)*	*(0.255)*	*(0.206)*	*(0.610)*
Proportion of Younger Brothers	0.345	0.876	0.420	0.215	-0.070	0.394
	(0.415)	*(0.519)*	*(0.681)*	*(0.344)*	*(0.459)*	*(0.641)*
Mom Ill past 4 years	0.047	0.231	0.056	-0.125	-0.267*	-0.178
	(0.152)	*(0.234)*	*(0.163)*	*(0.170)*	*(0.151)*	*(0.208)*
Dad Ill past 4 years	0.348**	0.139	0.244	-0.292**	-0.162	-0.137
	(0.154)	*(0.233)*	*(0.267)*	*(0.131)*	*(0.139)*	*(0.215)*
Other Ill past 4 years	0.089	-0.153	0.315*	-0.288	-0.188	-0.352
	(0.157)	*(0.200)*	*(0.154)*	*(0.202)*	*(0.161)*	*(0.327)*
Death in the Household past 4 years	0.223	-0.074	0.358	0.019	-0.180	0.261
	(0.220)	*(0.214)*	*(0.345)*	*(0.212)*	*(0.207)*	*(0.375)*
New Household Member past 4 years	0.173	0.036	0.312	0.046	-0.352	0.396
	(0.229)	*(0.266)*	*(0.250)*	*(0.274)*	*(0.244)*	*(0.345)*
Drought past 4 years	-0.168	-0.076	-0.422	0.805***	0.418	1.269***
	(0.272)	*(0.249)*	*(0.354)*	*(0.280)*	*(0.314)*	*(0.365)*
Flood past 4 years	0.211	0.218	0.066	0.433	0.004	0.998***
	(0.229)	*(0.271)*	*(0.323)*	*(0.282)*	*(0.281)*	*(0.340)*
Frost past 4 years	-0.452**	-0.067	-0.173	0.604**	0.307	0.320
	(0.210)	*(0.433)*	*(0.295)*	*(0.255)*	*(0.340)*	*(0.421)*
Death of Livestock past 4 years	0.183	0.329	-0.087	0.418***	0.418**	0.431**
	(0.176)	*(0.236)*	*(0.181)*	*(0.145)*	*(0.153)*	*(0.201)*
Constant	2.807***	3.142***	1.957***	0.680**	0.828**	0.795
	(0.322)	*(0.396)*	*(0.444)*	*(0.266)*	*(0.331)*	*(0.485)*
Observations	781	391	390	781	391	390
R-squared	0.051	0.083	0.057	0.104	0.068	0.191
F-test	8.615	6.435	5.664	9.466	4.749	6.641

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.3.b – Summary of Effects of Domestic and Market Work on Schooling Outcomes using Self-Reported Data for Children Aged 12 Years Old (Older Cohort Round 2)

	All		Female		Male	
	OLS	IV	OLS	IV	OLS	IV
PPVT Score						
Total hours of domestic work	-0.045***	-0.042	-0.036*	-0.102	-0.060**	-0.217
	(0.013)	*(0.083)*	*(0.019)*	*(0.086)*	*(0.028)*	*(0.157)*
Total hours of market work	-0.043*	-0.114	-0.042*	-0.18	-0.047	-0.169
	(0.023)	*(0.143)*	*(0.022)*	*(0.217)*	*(0.033)*	*(0.135)*
Mathematics Test Score						
Total hours of domestic work	-0.048*	0.027	-0.051*	-0.054	-0.054	0.133
	(0.027)	*(0.103)*	*(0.028)*	*(0.118)*	*(0.047)*	*(0.220)*
Total hours of market work	-0.019	-0.05	0.004	0.229	-0.025	0.105
	(0.025)	*(0.129)*	*(0.028)*	*(0.197)*	*(0.031)*	*(0.155)*
Observations	782	781	391	391	391	390

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.4.a – First Stage Estimations for Children Aged 15 Years Old

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Younger Sisters	0.426	1.287***	-0.085	0.4	-0.429	1.04
	-0.341	*-0.294*	*-0.381*	*-0.489*	*-0.424*	*-0.664*
Proportion of Younger Brothers	0.385	0.416	0.091	0.028	-0.103	0.406
	-0.334	*-0.28*	*-0.454*	*-0.441*	*-0.34*	*-0.594*
Mom Ill past 4 years	0.316	0.620**	0.253	0.029	-0.057	-0.051
	-0.184	*-0.239*	*-0.253*	*-0.215*	*-0.19*	*-0.274*
Dad Ill past 4 years	0.092	-0.259	-0.005	-0.211	-0.089	0.033
	-0.237	*-0.235*	*-0.314*	*-0.219*	*-0.217*	*-0.347*
Other Ill past 4 years	0.013	-0.052	-0.131	-0.17	-0.199	0.016
	-0.16	*-0.158*	*-0.183*	*-0.165*	*-0.186*	*-0.275*
Death in the Household past 4 years	-0.412*	-0.405	-0.485*	0.209	-0.329	0.839
	-0.205	*-0.298*	*-0.235*	*-0.36*	*-0.205*	*-0.517*
New Household Member past 4 years	0.177	0.323	0.276	0.059	-0.51	0.224
	-0.22	*-0.331*	*-0.25*	*-0.428*	*-0.311*	*-0.489*
Drought past 4 years	0.208	0.411	-0.408	0.884**	0.760***	1.328***
	-0.223	*-0.266*	*-0.264*	*-0.314*	*-0.244*	*-0.444*
Flood past 4 years	-0.048	-0.450*	0.333	0.37	0.057	0.781
	-0.15	*-0.222*	*-0.298*	*-0.217*	*-0.211*	*-0.475*
Frost past 4 years	0.347	0.563*	0.172	0.184	0.148	0.129
	-0.264	*-0.308*	*-0.354*	*-0.197*	*-0.225*	*-0.32*
Death of Livestock past 4 years	0.385*	0.829***	0.065	0.466*	0.158	0.703**
	-0.211	*-0.265*	*-0.23*	*-0.241*	*-0.226*	*-0.318*
Constant	2.731***	3.422***	2.199***	1.048***	0.606***	1.353***
	-0.225	*-0.31*	*-0.18*	*-0.244*	*-0.202*	*-0.308*
Observations	782	391	391	782	391	391
R-squared	0.036	0.162	0.029	0.06	0.067	0.133
F-test	6.342	7.723	2.608	4.957	6.239	5.397

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.4.b – Summary of Effects of Domestic and Market Work on Schooling Outcomes using Self-Reported Data for Children Aged 15 Years Old

	All		Female		Male	
	OLS	IV	OLS	IV	OLS	IV
PPVT Score						
Total hours of domestic work	-0.031	-0.287	-0.078**	-0.336**	0.002	0.008
	(0.019)	*(0.189)*	*(0.033)*	*(0.170)*	*(0.033)*	*(0.157)*
Total hours of market work	-0.035**	-0.388	-0.053	-0.337	-0.024	0.026
	(0.016)	*(0.295)*	*(0.039)*	*(0.210)*	*(0.020)*	*(0.129)*
Mathematics Test Score						
Total hours of domestic work	-0.033*	-0.317	-0.044*	-0.288	-0.032	-0.105
	(0.018)	*(0.221)*	*(0.024)*	*(0.182)*	*(0.040)*	*(0.247)*
Total hours of market work	-0.048***	-0.579	-0.039**	-0.037	-0.064**	-0.302
	(0.014)	*(0.438)*	*(0.017)*	*(0.095)*	*(0.025)*	*(0.203)*
Observations	782	782	391	391	391	391

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1