Heterogeneous Impacts of Shocks on Child Labour: Evidence from Rural Ethiopia

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Abstract

Rural households in developing countries are exposed to a plethora of shocks that usually have unpleasant consequences such as the use of child labour as a coping strategy. We empirically test this using a sample of 1727 children observed in three waves (2010/11, 2012/13 and 2014/15) from Ethiopian Rural Socio-economic Surveys. According to the results from multilevel mixed effects tobit models, idiosyncratic shocks (such as illness or death of family member) drive children to work more outside home while covariate shocks (such as flood, drought, heavy rain, and landslides) increase total hours of child work including household activities such as fetching water and firewood. Results of the study also support the hypothesis that non-labour income and credit access buffer against shocks and prevent households from having to rely on child labour as a coping strategy. Policies that foster smooth functioning of labour markets, coupled with social protection programs that incentivize schooling of children, are likely to be effective in helping households to withstand shocks without resorting to child labour.

Keywords: Heterogeneous impacts, Shocks, Child labour, rural Ethiopia

1. Introduction

Households in developing countries are frequently hit by idiosyncratic shocks (such as illness or death of family member, asset loss and crop damage) and covariate shocks (such as flood, drought, heavy rain, and landslides (Zelalem, 2009; Shehu and Sidique, 2015). Poor rural households are particularly vulnerable to such shocks as they do not possess the necessary assets to mitigate the adverse effects (Shehu and Sidique, 2015). Having limited access to formal coping mechanisms, they commonly rely on informal coping measures such as borrowing, receiving remittances and

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transfers, selling productive assets, adjusting food intake, and use of child labour (Beegle *et al.*, 2003; Beegle *et al.*, 2006; Bandara *et al*., 2014; Shehu and Sidique, 2015).

Worldwide, 218 million children aged from 5 to 17 are involved in child labour and most of them reside in the least developed countries (ILO, 2017). Slightly more than one in four children in developing countries are engaged in activities that may compromise their physical, mental, social or educational development (UNICEF, 2019). Ethiopia is one of the countries with the highest rates of child labour in the world, with well over 40 percent of children aged 5 to 17 years engaged in child labour (CSA and ILO, 2018; CSA, UNICEF Ethiopia and C4ED, 2020).

Given the high prevalence of child labour in the developing world, the issue of child labour happens to be of a great relevance. Recent empirical evidences show higher tendencies to use child labour as a buffer against unexpected shocks, especially when households face a binding adult labour constraint (Bhalotra and Heady, 2003; Zelalem, 2010). Few studies attempted to test the extent to which child labour is used as a buffer against shocks in Africa. For instance, Beegle *et al.* (2003) and Beegle *et al.* (2006) provided robust evidence of a causal positive relationship between transitory shocks (such as crop loss) and intensity of child labour in Tanzania. Households respond to such shocks by increasing their use of child labour at the cost of lower school enrolment.

Only few studies consider the importance of distinguishing between different categories of shocks and work activities in the analysis of child labour. Bandara *et al.* (2014) considered two types of shocks in Tanzania: income shocks (agricultural shocks) and non-income shocks (the death of parents or relatives) and found a significant effect of only agricultural shocks in terms of increased hours of child work, especially for boys and adverse effects on school attendance, mainly for girls. Similar results are reported by Beegle *et al.* (2008) for rural Tanzania, where crop shocks lead to increases in hours of agricultural work for boys and hours of household chores for girls.

Few studies assessed heterogeneity in the effects of shocks on child labour depending on availability of alternative coping mechanisms such as asset ownership, credit access and informal networks. The extent to which child labour is used as a buffer is lower when households have asset holdings. For instance, Beegle *et al.* (2006) have shown that economic shocks induce child labour but less so when households own assets. Also, access to credit (measured by access to a bank account) was found to mitigate the impact of crop loss on hours worked by girls in Northern Mali (Dillon, 2013).

Dillon (2013) analysed the impact of crop loss and morbidity on child labour in northern Mali. Crop loss was found to increase children 's participation on farm work at the expense of school attendance while health shocks significantly affected child labour at the intensive margin, but had no effect on school attendance. Dillon's findings suggest that whether child labour is used as a risk coping strategy highly depends on the type of shock and the type of work:

Prior studies from Ethiopia focused on non-economic factors associated with child labour and schooling (Assefa, 2001; Getinet and Beliyou, 2012). Only recently, few studies tried to relate shocks with child labour. For example, Zelalem (2010) assessed the differential impact of shocks on child labour in rural Ethiopia and confirmed the claim that child labour is used as a self-insurance mechanism. Moreover, the study highlighted the substantial benefits of an informal social network (membership in a labour sharing arrangement that renders labour upon need), in terms of lessening the pressure to draw on child labour at times of idiosyncratic shocks, but not covariate shocks.

Also, Colmer (2013) assessed the effect of climate variability on child labour and schooling in Ethiopia. According to his results, climate variability increases hours worked on the farm and decreases hours worked in the home, which suggests substitution between activities. More recently, Yonatan (2018) examined the effect of parental health shocks on the allocation of children's time using the Young Lives Survey panel data for Ethiopia. According to their results, paternal illness increases children's time spent in income-generating work while maternal illness increases time

spent in domestic work. Furthermore, the results suggest that child time allocation is influenced by traditional gender roles where maternal illness has a relatively large effect on girls while paternal illness has a relatively large effect on boys.

Existing studies on the area have a number of limitations. First, prior works on child labour focus almost exclusively on the extensive margin using dichotomous measures for whether a child participates in a certain activity or not, with no explanation of the substantial variation in the intensity of child work. Second, the link between shocks, child labour and other coping mechanisms remains largely unexplored. Third, many studies use aggregate shock measures and lump different types of work activities, making it difficult to address how different types of shocks may impact different forms of child labour in various ways. Usually, studies solely consider economic activities, overlooking domestic chores, which take prominent share of child labour in most developing countries. This is mainly due to paucity of data on household activities and opacity in the distinction between economic and housework in rural settings. Such analysis is an understatement of child labour; particularly girls' participation in domestic chores.

This paper aims to test the hypothesis that exposure to shocks increases households' reliance on child labour. Precisely, this paper endeavours to examine the extent to which idiosyncratic and covariate shocks lead to greater intensity of child work in different activities in rural Ethiopia. The paper also probes whether availability of coping strategies, such as non-labour income and credit access, help households ease the pressure to draw on child labour when hit by shocks.

This paper contributes to the literature in several ways. First and foremost, it contributes to better understanding of the effect of different types of shocks (idiosyncratic and covariate shocks) on hours of child work allocated across different rural activities, including domestic chores. Children's involvement in household activities is considered in addition to economic works in order to get a comprehensive understanding of child work in rural areas where children, especially girls, spend substantial amounts of time in household

activities. Splitting up child labour in its components is also helpful to scrutinize the heterogeneous impact of shocks as different categories of shocks may not equally affect hours of child work in different activities. Besides, this research complements current efforts in the literature that focus on the implications of coping mechanisms (such as access to credit and insurance mechanisms) in mitigating the impact of shocks on child vulnerability in the context of a rural subsistence economy.

More importantly, the analysis in this paper is based on an appropriate empirical methodology that accounts for a number of empirical issues, including endogeneity and the fact that the hours of work child are left-censored. Multilevel analysis is used considering the nested nature of the data and in order to exploit the available panel data. It helps to control for unobserved time-invariant characteristics that potentially influence the household's decision on child time allocation. Overall, the findings from this empirical study help to identify important determinants of child labour; therefore, guides formulation of policies and mechanisms that can be used to tackle child labour and its repercussions.

2. Data and Methods

2.1. Data Description

The analysis in this paper is based on a rich and nationally representative data from the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) of the World Bank in collaboration with the Central Statistical Agency (CSA) of Ethiopia. We used data from the three rounds (2010/11, 2012/13 and 2014/15). The survey dataset is appropriate for the proposed analysis of shock-specific adjustments in child labour. In particular, the panel structure allows to control for unobservable variables and to exploit the dynamics in child work and schooling status over time.

The dataset entails information about shocks faced by households in the past 12 months prior to the survey and coping strategies. Also, there is detailed information on individuals and household characteristics, including information on time use of all household members aged seven and older. This includes information on hours spent in the previous week of the survey working on agricultural activities, non-agricultural activities, temporary or

casual work or salaried job, and unpaid apprentice. There is also data on hours and minutes spent yesterday fetching water and firewood. In our analysis, the former information was used to proxy for child time spent in economic activities while the latter was used to proxy for household activities. In fact, household activities include many other time- taking domestic activities (such as cooking and serving meals, cleaning, caring for younger siblings, infirm, disabled, or elderly household members), which are not considered in the time-use data employed for this study. Since we do not have data on all kinds of domestic chores, we only use information on hours spent fetching water and firewood to proxy for housework.

In line with the child labour literature from developing countries, the analysis is done on a restricted sample of rural households with children aged 7-17 years. The restricted sample consists of 1727 children observed in three waves, resulting in a pooled sample of 5181 children.

2.2. Methods

Existing literature on child labour raises methodological problems related to nature of data and on how to measure child labour. Other potential problems include attenuation bias, between and within household selection bias, and endogeneity.

An obvious challenge in analysing time allocation decisions is the presence of large number of zero-value observations in the data, as it is common to see zero time spent in many activities. In this paper, the analysis of hours of child work is based on a Tobit model assuming that observed zero values are due to censoring. The model accounts for the large number of children that are not engaged in any type of child work without having to restrict the sample to only working children; thereby addresses the potential problem of sample selection bias (Wooldridge, 2012).

The standard Tobit models for the analysis of hours of child work is given by Equation (1).

$$y_{ij} = \begin{Bmatrix} (y_{ij})^* \; if \; (y_{ij})^* > 0 \\ 0 \; otherwise \end{Bmatrix} \qquad (1)$$

where the latent variable, given by $(y_{ij})^*$, denotes the desired hours of child work while y_{ij} denotes the actual observed hours of child work.

The standard Tobit model assumes corner solutions where the latent and the observed dependent variables are equal when the latent variable is greater than zero, but the observed variable is zero when the latent variable is negative (Tobin, 1958).

Another challenge in estimating the effect of shocks on child labour is the possible endogeneity of some shocks. In particular, the occurrence of idiosyncratic shocks may relate with unobservable household characteristics that may also partly explain child work, and therefore could bias estimation results. For example, poor and less forward-looking households might be both prone to shocks and inclined to sending their children to work as they may place less value on formal education. In this paper, we address the aforementioned problem using ***multivariate analysis***, which is an alternative to panel analysis. This is considered to be more appropriate for two reasons.

First, multilevel model helps to deal with the panel structure of the data by considering observations across waves as one level in the hierarchical model. Note that children are observed overtime and a child's responses over time are correlated with each other. Multilevel analysis is special case of random effect models (Rabe-Hesketh and Skrondal, 2012) and has advantage over the fixed effects model in panel analysis. The fixed effects model controls household level variables but is unable to estimate the effect of any variable that does not vary within clusters. Besides, multilevel models allow the option to control for complex survey designs in exploiting the panel structure of the data.

Second, multilevel model is appropriate to deal with the hierarchical/clustered structure of our data. That is, children are nested within households and outcomes of children from the same household are correlated as they are affected by the same unobserved household characteristics and they share common household-level random effects. Multilevel modelling allows to recognize the hierarchical structure of our data by allowing the error term in our regression be structured according to

the known hierarchy.[1] Besides, multilevel model is appropriate for our analysis since some explanatory variables are measured at household level and others at child level. The model provides within estimates of child level variables and allow inclusion of household level variables.

Specifically, we estimate a three-level hierarchical model with clustered standard errors. Level one refers to occasions (children observed at different waves) while levels two and three refer to child level and household level respectively. For the sake of simplicity, we consider only levels two and three and present the following parsimonious multilevel model for a given point in time:

$$y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 h_j + \beta_3\, Idio\_shocks_j + \beta_4 Cov\_shocks_j + v_{ij} + u_j \qquad (2)$$

y_{ij} denotes the outcome variable (hours of child work) of child-i nested in household-j. Specifically, the dependent variables for the analysis of child work on the intensive margin are '*weekly hours spent on economic activities'* (agricultural and non-agricultural) and '*daily hours and minutes spent on household activities'* (fetching water and firewood).

y_{ij} is expressed as a function of a vector of child level covariates (x_{ij}) that vary between and within clusters, and a vector of household level covariates (h_j). The main variables of interest for our analysis are the *shock indicators.* We included separate indicators for *idiosyncratic* and *covariate shocks* in order to discern among the potential heterogeneous effects of different shocks. *Idiosyncratic shocks* are captured by a dummy variable that takes the value of 1 if any member of the household faces serious illness or death during the past 12 months prior to the survey while c*ovariate shocks* are captured by a dummy variable that takes the value of one if a household reported to have faced drought, flood, heavy rain or landslides in the last 12 months prior to the survey.

Both shock indicators are relevant in the context of rural Ethiopia. Covariate shocks have a significant negative effect on agriculture production, which is the main economic activity in rural Ethiopia. Given

that working children in rural Ethiopia are mainly engaged in agriculture, such shocks affect children's marginal product of labour on the family farm.

Idiosyncratic shocks, such as death or illness of adult family members, are common shocks faced by poor households in many developing countries including Ethiopia. And it is well documented that such shocks induce sudden changes in family composition, which places additional and heavy responsibilities on children in rural households (Zelalem, 2010).

We further extend Equation (1) by controlling for factors such as households' non-labour income and access to credit, which may mitigate the effect of shocks on child labour (see Equation 3). The factors are interacted with shock indicators in order to test the importance of such buffering mechanisms in helping families to ease the effect of shocks on child labour.

$$y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 h_j + \beta_3\, Idio\_shocks_j + \beta_4 Cov\_shocks_j + \beta_5 buffers_j + \beta_6 idio\_shock_j * buffers_j + \beta_7 cov\_shock_j * buffers_j + v_{ij} + u_j \quad (3)$$

We expect the coefficient of shocks to be positive $(\beta_3\ ,\ \beta_4 > 0)$ as certain shocks may force households to use more child labour. And, we expect negative values for the coefficients of the interaction terms $(\beta_6\ ,\ \beta_7 < 0)$, which capture the differential impact of shocks among children from households with different status.

Differences in household status (say in terms of asset holdings and access to finance) have direct implications on households' labour allocation decisions of rural households, especially when there is high degree of market imperfections. Non-labour income and access to credit are expected to ease liquidity constraints and raise household income and therefore help households overcome transitory shocks (Maldonado and González-Vega, 2008). But, the benefits of such coping mechanisms may be limited in case of certain types of shocks, say covariate shocks that affect a whole community (see Beegle *et al*., 2003; Beegle *et al*., 2006; Zelalem, 2010; Dillion, 2013; Yonatan, 2018).

Child and household level random error terms, given by v_{ij} and u_j respectively, are assumed to be independently and normally distributed with zero mean and constant variances given by σ_v^2 and σ_u^2. The independent assumption is violated in the presence of clustering, where groups of children may be in the same household. This is dealt with by allowing child-level intercept to vary across households in order to explicitly model dependence among children within the same household.

The causal interpretation of results from the analysis in this paper relies on the assumption of independence of the household-level error term, conditional on regressors included in the model. Estimates from the random effects models are consistent if the distributional assumption of the household-level error term holds: $u_j\ /x_{ij}, h_j \sim N(0, \sigma_u^2)$ and $E(u_j\ /x_{ij}, h_j) = 0.$

However, the independent assumption can be violated due to existence of unobserved household characteristics that are correlated with observed child characteristics that affect child work (that is, $cov(x_{ij}, u_j) \neq 0$). More specifically, the assumption will not hold if there are unobserved random variables that affect households' exposure to shock and child work at the same time. Identification comes from time variations in household's exposure to shocks for the same child, and the underlying assumption of the model is that these variations are exogenous, conditional on the set of independent variables. In practice, children living in a household with specific socio-economic conditions may be systematically more likely to be exposed to shocks, but the time variation in shocks should not be related to measures of child work (Bratti and Mendola, 2014). Failure to account for endogeneity problem resulting from such potential correlation results in biased estimation.

3. Results and Discussion

3.1. Summary Statistics

Table A2 in the appendix presents descriptive statistics of variables used in the analysis. The first column of Table A2 reports the summary statistics for the pooled sample of children aged 7 - 17 years. Then, the sample is

separated into sub-samples of children in households that had experienced a shock and those that had not. The respective descriptive statistics for the sub samples are reported in the second and third columns of Table A2.

Fifty-six percent of the children in our sample reported to have allocated some time to economic activities in the reference week while 44 percent of the children were reported to have spent some time each day fetching water and firewood. Most children engage in agricultural activities (about 54 percent) while only about five percent of the children reported positive hours of non-agricultural work. Paid employment for children is rare; only few children were engaged in wage employment or non-farm family businesses; but many households rely on children to work in the house or on the family farm.

There is apparent gender inequality in terms of incidence and intensity of child work. About 66 percent of the boys and 46 percent of girls reported to have spent some time in economic activities in the past seven days. Figure 1a clearly shows that boys are more likely than girls to engage in economic activities for excessive hours, conditional on working: 13 percent of the boys (relative to only 6 percent of the girls) report to have spent more than 42 hours a week in economic activities. On the other hand, girls are assumed to shoulder a greater responsibility for housework in most societies. 57 percent of the girls (and only 32 percent of the boys) in the sample reported to have spent some time fetching water and firewood in the previous day. Majority of the girls in our sample were involved in domestic chores that do not occupy considerable amount of their time (see Figure 1b).

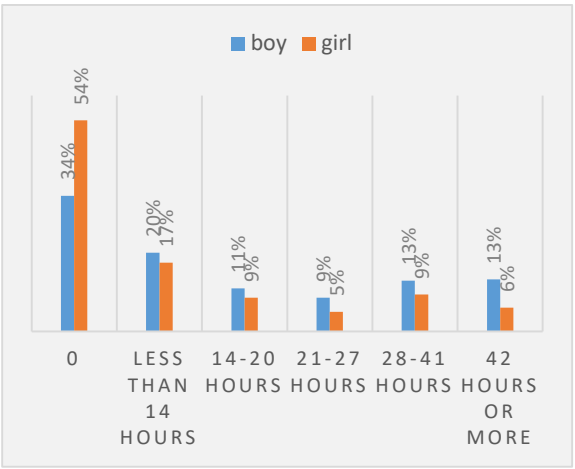

Figure 1a: Percentage of children engaged in economic activities by weekly hour bracket and sex

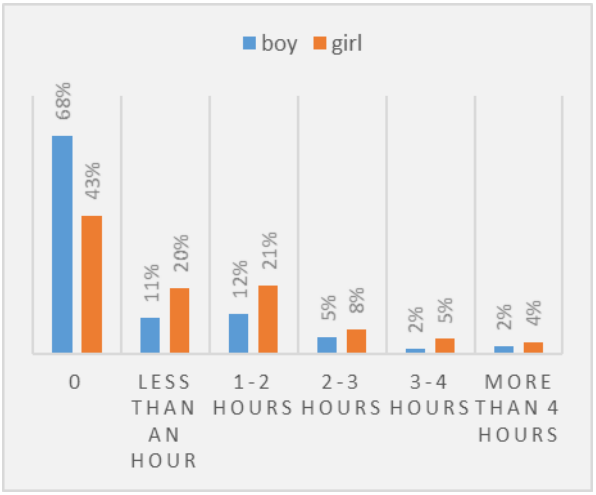

Figure 1b: Percentage of children performing household chores, by daily hour bracket and sex

Source: Own computation based on the restricted sample of children (7-17 years old) from rural Ethiopia.

Overall, boys were more likely than boys to engage in economic activities at every age cohort and weekly hour range. On the other hand, girls were much more likely than boys to perform household chores at every age cohort and

daily hour range. Figures 2a and 2b below demonstrate that gender gap in both economic- and house-work participation increases with age.

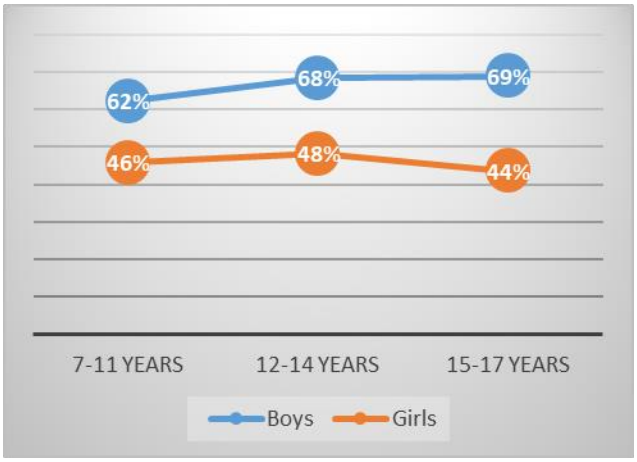

Figure 2a: Percentage of children that report positive hour spent in economic activities per week, by age cohort and sex

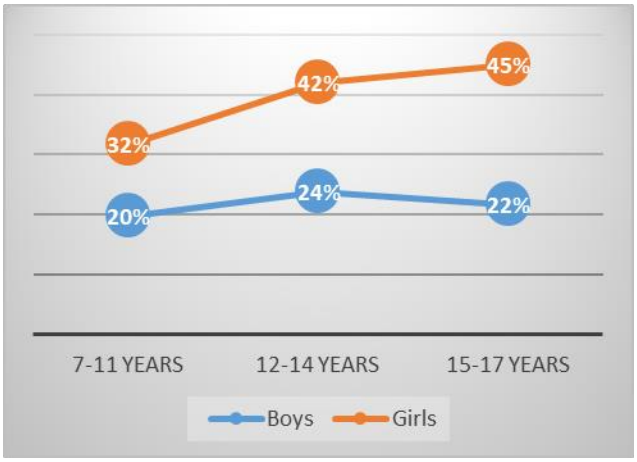

Figure 2b: Percentage of children performing household chores for at least one hour per day, by age cohort and sex

Source: Own computation based on the restricted sample of children (7-17 years old) from rural Ethiopia.

There are different criteria for identifying any given work as child labour. According to ILO's definition, child labour refers to a child under 12 who participated in an economic activity for at least one hour per week, a child

aged 12 to 14 who participated for at least 14 hours per week (two hours per day), and a child aged 15 to 17 who participated for at least 43 hours per week. An alternative definition of child labour that considers household chores is the one suggested by UNICEF. For children aged 5-11 years, child labour is defined as domestic chores in excess of 28 hours per week (that is four hours per day) or any income-generating work; for children aged 12-14 years, child labour is defined as domestic chores in excess of 28 hours per week or income-generating work is excess of 14 hours per week (ILO, 2017).

According to the statistics computed based on ILO's definition of child labour (that is, with the concept of child labour restricted to economic activities), more than half of children under 12 years and about one third of children aged between 12 and 14 years were in child labour. As clearly shown in Figure 3a, boys appear to face a greater risk of child labour than girls; boys account for more than 60 percent of all children in child labour. And the gender gap increases with age. The gender difference in child labour incidence is 16 percentage points for 7–11-year-old, and it rises to 20 percentage points for 12–14 year-olds. But this may be in part a reflection of an under-reporting of girls' work relative to that of boys. In rural Ethiopia, girls' work more in under-reported forms of child labour such as household chores in their own homes.

The statistics computed based on UNICEF's criteria for identifying any given work as child labour yields similar results on the prevalence of child labour in rural Ethiopia. The statistical finding also supports the claim that the prevalence of child labour was somewhat higher for boys than for girls, even after controlling for household chores (see Figure 3b).

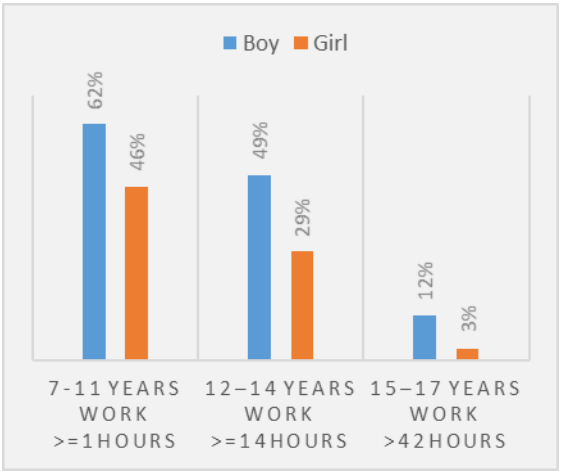

Figure 3a: Prevalence of child labour in rural Ethiopia based on ILO's criteria for identifying any given work as child labour

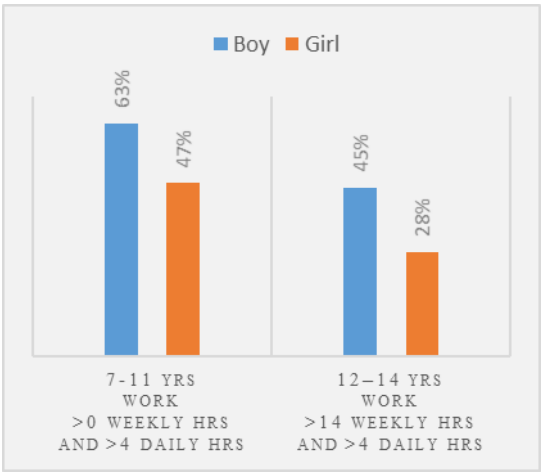

Figure 3b: Prevalence of child labour in rural Ethiopia based on UNICEF's criteria for identifying any given work as child labour

Source: Own computation based on the restricted sample of children (7–17 years old) from rural Ethiopia.

Shocks and hours of child work

Households in rural Ethiopia are exposed to several shocks which affect their welfare. About one-fourth of the children reside in rural households that reported to have being affected by a shock in the previous 12 months. Specifically, 20 percent of the children reside in households that were hit by covariate shocks such as drought, flooding, heavy rain, landslides and

market related shocks. Nine percent of the children reside in households hit by idiosyncratic shocks such as loss of crops or livestock, illness and death of household members (see Table A2).

Rural households use different mechanisms to cope with the aforementioned shocks. Most commonly, they rely on informal mechanisms such as use of own savings, sell assets, and use finance from different sources (borrowing and transfers). Households also reallocate labour; they use child labour as a buffer against shocks when faced with binding adult labour constraint.

In order to check if there is significant difference in child time allocation between households that experienced a shock and those that did not, the sample is separated into two sub-samples based on occurrence of shock. Mean hours of child work as well as most other covariates were similarly distributed in two sub-samples (see Table A2). Conditional on working, average hours of child work were slightly higher when a child belongs to a household that has experienced a shock compared to children from households that did not report any shock in the last 12 months. Relative to households not hit by shocks, children residing in households hit by a shock spend on average 1.65 more weekly hours on economic activities and 0.4 hours (24 minutes) daily hours fetching water and firewood.

3.2. Econometrics Analysis

This section presents the main empirical findings from investigation of the impacts of shocks on child labour in the context of rural Ethiopia. For each analysis, a multilevel model was fitted[2], incorporating children nested within households. The model has two random-effects equations to account for unobserved heterogeneity among children: a random intercept at the household-level, and a random intercept at the child-level.

The mixed-effects Tobit regression model estimation report the estimated variance components and the fixed effects. But we are interested in the marginal effect of covariates on the observed outcome (hours of child work). Thus, we estimate the average marginal effect of a covariate on the expected value of the actual hours worked.

The log likelihood ratio (LR) test is significant, indicating substantial variability in the variance of the intercept (see Table 1 and Table 2). The reported likelihood-ratio test shows that there is enough variability between households to favour a mixed-effects Tobit over a standard Tobit regression. This is confirmed by looking at the intra-class correlation (ICC), which refers to the fraction of variance that can be attributed to each level. The fact that the ICC is greater than zero indicates the existence of clustering in the data. Furthermore, the ICC signifies that about 20 percent of the variance in child labour is at household level.

Heterogeneity in the effect of shocks based on categories of shocks and types of activities

We examine some avenues of heterogeneity in analysing the effect of shocks. We begin by examining heterogeneity in the effect of shocks based on different types of shocks (idiosyncratic and covariate shocks) and work activities (economic and household activities).

Table 1. Estimation results for child work in different rural activities

	TOTAL		**BOYS**		**GIRLS**	
Variables	**Weekly hours spent on economic activities**	**Daily hours and minutes spent on household activities**	**Weekly hours spent on economic activities**	**Daily hours and minutes spent on household activities**	**Weekly hours spent on economic activities**	**Daily hours and minutes spent on household activities**
Idiosyncratic_shock	4.127**	0.172	0.412	-0.052	5.746**	0.403**
	(1.90)	(0.11)	(2.91)	(0.14)	(2.26)	(0.17)
Covariate_shock	0.965	0.105***	0.606	0.059	1.466*	0.140**
	(0.62)	(0.04)	(0.92)	(0.04)	(0.78)	(0.06)
Boy	6.581***	-0.499***				
	(0.49)	(0.03)				
Age of child	0.589***	0.060***	0.764***	0.036***	0.320**	0.096***
	(0.11)	(0.01)	(0.17)	(0.01)	(0.15)	(0.01)
Biological_child	-1.526	-0.146**	-1.781	-0.005	-1.179	-0.300***
	(1.15)	(0.07)	(1.65)	(0.08)	(1.54)	(0.11)
Male_head	0.208	-0.024	-0.470	0.008	0.753	-0.066
	(1.06)	(0.06)	(1.52)	(0.07)	(1.23)	(0.09)
Age_head	-0.022	0.001	-0.005	0.001	-0.047	0.001
	(0.03)	(0.00)	(0.04)	(0.00)	(0.03)	(0.00)
Schooling_head	-0.187*	0.002	-0.146	0.008	-0.214*	-0.007
	(0.11)	(0.01)	(0.15)	(0.01)	(0.13)	(0.01)
No of infants(<6yrs)	0.136	0.013	0.256	0.003	-0.151 (0.40)	0.031
	(0.32)	(0.02)	(0.47)	(0.02)		(0.03)
No of male adults	-1.278***	-0.032*	-1.671***	-0.038*	-0.972***	-0.005
	(0.29)	(0.02)	(0.42)	(0.02)	(0.36)	(0.03)
No of female adults	-0.564*	-0.127***	-0.742	-0.107***	-0.274 (0.41)	-0.178*** (0.03)
	(0.33)	(0.02)	(0.50)	(0.03)		
landsize_percapita	1.265	-0.076	1.851	0.119	0.314	-0.335**
	(1.41)	(0.09)	(2.03)	(0.10)	(1.83)	(0.14)
Livestock_holding	0.197*	-0.015**	0.533***	-0.014	-0.099	-0.017
	(0.10)	(0.01)	(0.15)	(0.01)	(0.14)	(0.01)
Log(Nonla	-0.167	0.009	-0.258	0.006	-0.070	0.014
Labour_income)	(0.12)	(0.01)	(0.17)	(0.01)	(0.16)	(0.01)

	TOTAL		BOYS		GIRLS	
Variables	**Weekly hours spent on economic activities**	**Daily hours and minutes spent on household activities**	**Weekly hours spent on economic activities**	**Daily hours and minutes spent on household activities**	**Weekly hours spent on economic activities**	**Daily hours and minutes spent on household activities**
Credit_access	1.515***	0.046	2.139***	-0.044	0.975	0.138***
	(0.52)	(0.03)	(0.75)	(0.04)	(0.67)	(0.05)
Year dummies (relative to 2011)						
yr_2013	-1.358*	-0.158***	0.472	-0.148***	-2.774***	-0.185***
	(0.71)	(0.04)	(1.05)	(0.05)	(0.92)	(0.07)
yr_2015	-2.230*** (0.78)	-0.250***	-1.200	-0.249***	-2.677***	-0.262***
		(0.05)	(1.17)	(0.06)	(1.01)	(0.08)
Region dummies						
Region_Tigray	4.733***	-0.004	7.403***	0.131	1.381	-0.209*
	(1.26)	(0.08)	(1.77)	(0.09)	(1.54)	(0.12)
Region_Amhara	5.691***	-0.008	7.776***	0.059	2.972**	-0.109
	(0.99)	(0.06)	(1.39)	(0.07)	(1.21)	(0.09)
Region_Oromia	0.766	0.066	1.302	0.074	-0.123	0.007
	(0.98)	(0.06)	(1.40)	(0.07)	(1.14)	(0.09)
Region_SNNP	-2.739***	0.261***	-2.063	0.395***	-3.783***	0.005
	(0.95)	(0.06)	(1.34)	(0.07)	(1.12)	(0.08)
Observations	***5181***	***5181***	***2745***	***2745***	***2436***	***2436***
Left-censored observations	*2254*	*2890*	*946*	*1854*	*1128*	*1036*
Uncensored observations	*2927*	*2291*	*1799*	*891*	*1308*	*1400*
Log likelihood	*-15226.46*	*-6362.2*	*-9093.59*	*-2807.56*	*-6130.05*	*-3499.97*
LR test vs. tobit chibar2(01)	*185.43*	*201.00*	*94.44*	*98.47*	*59.35*	*69.78*
Prob > chibar2	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*

Note: Average marginal effects (dy/dx) are reported with robust standard errors in parentheses.

*, **, *** indicate significance at 10%, 5% and 1%, respectively.

The first two columns of Table 1 display results for determinants of different types of child work with dependent variables: *weekly hours spent on economic activities*, and *daily hours spent on household activities (fetching water and firewood).*

The estimated results indicate that idiosyncratic shocks have a statistically significant effect on hours spent on economic activities while the covariate shocks have a statistically significant effect on time spent on household activities. In terms of magnitude, idiosyncratic shocks lead to an increase in mean hours spent on economic activities by 4.13 hours per week while covariate shocks lead to an increase in household activities by 0.11 hours (6.6 minutes) per day on average, controlling for other factors. Interestingly, the results show that the impact of idiosyncratic shocks is stronger than the effect of covariate shocks.

These results can be driven by several transmission channels. The effect of shocks can be mediated through a fall in household income (say, due to a fall in production when hit by covariate shocks or an increase in health expenditure when faced with idiosyncratic shocks) or a decline in adult labour that may lead to a need for the child labour to replace the sick/dead household member.

Heterogeneity in the effect of shocks based on sex of a child

Personal characteristics of children have implications on child labour. The statistically significant estimate on the variable for sex of a child suggests difference in hours of work between boys and girls (see Table 1). The positive sign for the sex dummy in the regression for weekly hours of economic work denotes that boys are more likely to involve in economic activities and spend about 6.58 weekly hours more than girls on average. On the other hand, the negative sign for sex dummy in the regression for daily hours of housework implies that girls spend more time collecting firewood and water; they spend about 0.5 hours (30 minutes) a day more than boys on average. This provides evidence for the existence of gender differences in tasks, which are particularly relevant if shocks affect the marginal product of labour in certain activities.

It is worth investigating whether the aforementioned gender differences in child work lead to asymmetries in the effects of shocks and other determinants of child work. Accordingly, a gender disaggregated analysis is run in order to test if results are homogenous for boys versus girls. Results reported in Table 1 suggest presence of substantial differences in the effect of shocks across boys and girls. According to the results, shocks significantly affect hours of work of only girls. Girls residing in households that faced idiosyncratic shocks spend, on average, about 5.75 weekly hours more on economic activities and 0.4 hours (24 minutes) more on daily household chores. Also, covariate shocks increase the mean time that girls spend in economic activities and household chores by about 1.47 hours a week and by 0.14 hours (8.44 minutes) a day, respectively.

Furthermore, results from gender disaggregated analysis imply that girls' personal characteristics have stronger effects on hours spent in household activities while boys' personal characteristics have stronger effects on hours spent in economic activities. The result shows that hours of work increases with age of a child. In case of hours spent in economic activities, marginal effect of age for boys is twice as large as that of girls while in case of hours spent in household activities, marginal effect for girls is almost three times that of boys. The fact that both boys and girls work more when they grow older is worrying as it means that older children (probably, adolescents in upper school) are overburdened with work, relative to younger children.

Another important feature that has implications on child labour is the relationship of a child with the household head. Biological children (son/daughter) work relatively less in housework, where girls are mostly responsible. This result is similar to that of Getinet and Beliyou (2012).

Estimates of some control variables suggest interesting patterns. Although age and sex of household head does not seem to affect involvement of boys and girls in any work, education level of the household head matters for child work in economic activities. Not surprisingly, we find that higher education level of parents leads to lower child labour for all levels of education. Girls from households with better educated heads are found to work relatively less. This is because education enhances earnings potential

and children of educated parents may not be as resource constrained as their counterparts from illiterate parents (Beegle *et al*., 2006; Ersado, 2005).

All of the household composition variables have statistically significant effects on child work except the number of infants in the household. Children residing in labour endowed households work fewer hours. The negative impact of household size (measured by number of adult men in the household) on hours of economic work is higher for boys relative to girls. On the other hand, the negative impact of household size (measured by number of adult women in the household) on hours of housework is higher for girls relative to boys. This is in line with our expectation as the presence of adult women in the household relieves children, mainly girls, of part of their housework burden and reduce children's work time through substitution effects (Admassie, 2001).

Land and livestock holding, which are the two most important productive resources rural households own, have implications on child time allocation. Per capita land holding is negatively associated with daily hours of housework for girls while livestock holding increases hours spent in economic activities for boys, who are most commonly responsible for herding in rural areas. The negative effect of land holdings on child labour is consistent with the "Income effect" theory. On the other hand, the positive effect of livestock holdings on child labour is in line with the "Substitution effect", which can be rationalized in case of rural agricultural settings with imperfect markets ('substitution effect'/wealth paradox) (Bhalotra and Heady, 2003).

Heterogeneity in the effect of shocks based on access to credit and non-labour income

Coefficients of interaction terms capture the differential impacts of shocks among children from households with different levels of non-labour income and access to credit. The interaction terms have the expected negative signs; however, none are significant at the conventional level for total children in our sample (see the first column of Table 2). Yet, further analysis disaggregated by sex and age group of the child yield significant results

supporting the hypothesis that both non-labour income and access to credit buffer against shocks and help ease the effect of shocks on child labour.

As indicated in the gender disaggregated analysis, non-labour income eases the effect of covariate shocks on child labour for boys only. Although households' non-labour income is not found to affect hours of work at normal times, it negatively affects boys' weekly hours spent in economic activities when households face covariate shocks.

Besides, it is important to note that access to credit plays a central role in child labour. Credit access significantly increase hours of child work at normal times. There is a significant buffering effect of credit access for young children under the age of 12 years. That is, for households that are hit by covariate shocks, young children residing in households with credit access allocate relatively less weekly hours to economic works as compared to children from households with no credit access. This finding points to imperfections in the adult labour market and household's inability to trade-off resources inter-temporally in an optimal way, both of which lead to child labour. Working children contribute to the current labour and earnings of a household, but at the cost of future earning of the children.

Table 2. Estimation results for heterogeneous effect of shocks on child work (hours of economic work)

Variables	**TOTAL**	**DISAGGREGATED BY SEX**		**DISAGGREGATED BY AGE**		
		BOY	**GIRL**	**< 12 YRS**	**12-14 YRS**	**>14 YRS**
Idiosyncratic_shocks	7.992**	0.537	13.199**	5.451	10.651*	-2.625
	(3.82)	(5.27)	(5.36)	(5.14)	(6.29)	(14.02)
Covariate_shocks	2.462*	2.517	2.877	4.110**	4.594**	-3.769
	(1.33)	(1.71)	(2.04)	(2.07)	(2.07)	(2.84)
Boy	11.529***			10.323***	11.682***	13.021***
	(0.86)			(1.25)	(1.34)	(2.53)
Age of child	1.027***	0.161***	0.687**	1.378***	0.191	1.094
	(0.19)	(0.26)	(0.32)	(0.48)	(0.76)	(1.27)
Bioloogical_child	-2.453	-2.537	-1.899	-4.526	-0.753	-3.078
	(2.03)	(2.53)	(3.32)	(3.00)	(3.09)	(4.26)
Male_ head	0.284	-0.869	1.481	-2.504	3.296	1.667
	(1.85)	(2.32)	(2.64)	(2.53)	(2.57)	(3.68)
Age_head	-0.040	-0.009	-0.101	-0.058	-0.046	-0.058
	(0.05)	(0.06)	(0.07)	(0.07)	(0.07)	(0.10)
Schooling_head	-0.332*	-0.220	-0.466*	-0.486*	-0.218	0.161

	(0.19)	(0.23)	(0.28)	(0.26)	(0.26)	(0.38)
No of infants(<6yrs)	0.249	0.447	-0.345	0.482	-1.338	0.646
	(0.56)	(0.71)	(0.86)	(0.84)	(0.83)	(1.21)
No of male adults	-2.238***	-2.544***	-2.065***	-2.953***	-2.478***	-0.692
	(0.51)	(0.64)	(0.77)	(0.80)	(0.73)	(1.05)
No of female adults	-0.973*	-1.157	-0.541	-0.230	-1.486*	-0.340
	(0.59)	(0.76)	(0.87)	(0.93)	(0.83)	(1.27)
Landsize_percapita	2.169	2.809	0.625	6.826*	-1.236	-10.757
	(2.47)	(3.09)	(3.91)	(3.52)	(3.55)	(9.40)
Livestock_holding	0.352*	0.827***	-0.232	0.442*	0.351	-0.435
	(0.18)	(0.23)	(0.29)	(0.25)	(0.29)	(0.98)
Log(Nonlabor_income)	-0.114	-0.078	-0.136	-0.470	0.456	-0.729
	(0.26)	(0.31)	(0.44)	(0.39)	(0.41)	(0.56)
Credit_access	2.935***	3.728***	1.977	3.940***	2.642*	2.717
	(1.02)	(1.28)	(1.60)	(1.47)	(1.60)	(2.47)
Interaction of shock with coping mechanisms						
Nonlabor_income*	1.065	0.057	3.503	1.159	-0.127	0.000
	(1.65)	(2.08)	(2.64)	(1.97)	(3.27)	(.)
Idiosyncratic_shock						
Nonlabor_income*	-0.566	-0.969*	-0.202	-0.412	-1.052	0.162
Covariate_shock	(0.43)	(0.53)	(0.68)	(0.68)	(0.65)	(0.88)
Credit_access*	-8.907	-0.275	-19.355	-20.009*	6.958	47.652*
	(8.68)	(10.64)	(14.56)	(11.38)	(16.25)	(28.39)
Idiosyncratic_shock						
Credit_access*	-0.883	-2.313	1.486	-4.483	3.408	-8.118*
Covariate_shock	(2.16)	(2.76)	(3.33)	(3.39)	(3.32)	(4.77)
Observations	**5181**	**2745**	**2436**	**2592**	**1804**	**785**
Left-censored observations	*2254*	*946*	*1128*	*1185*	*736*	*333*
Uncensored observations	*2927*	*1799*	*1308*	*1407*	*1068*	*452*
Log likelihood	*-15224.53*	*-9093.59*	*-6130.05*	*-7428.95*	***-5476.13***	*-2314.91*
LR test vs. tobit chibar2(01)	*182.03*	*94.44*	*59.35*	*63.95*	***16.79***	***9.85***
Prob >= chibar2	*0.0000*	*0.0000*	*0.0000*			

Average marginal effects (dy/dx) are reported with robust standard errors in parentheses.
*, **, *** indicate significance at 10%, 5% and 1%, respectively.

4. Conclusion and Implications

This study attempted to determine whether there is empirical evidence for the commonly made assumption that child work increases in response to shocks in the context of rural Ethiopia. The analysis is done using multilevel mixed effects Tobit models based on balanced panel data from Ethiopian Rural Socio-economic Surveys (ERSS).

The results confirm the claim that shocks induce child labour. Idiosyncratic shocks significantly increase children's time spent on economic activities while covariate shocks increase total hours of child work including household activities (fetching water and firewood). This is evidence of heterogeneity in the effect of shocks depending on both the category of shocks faced and type of activity that children involve in. Also, the results infer asymmetries in effects of shocks based on gender; only girls seem to experience the harmful effects from both idiosyncratic and covariate shocks, in terms of increased hours of work.

In addition, other household characteristics were found to influence households' decisions regarding child time allocation. Higher literacy level of household heads, and larger household size were found to discourage child work while livestock holding and access to credit intensify child work, especially for boys. Furthermore, this study provides evidence for heterogeneity in child labour across households with different levels of non-labour income and access to credit. There is a significant buffering effect of non-labour income against idiosyncratic shocks on child labour for boys, but not for girls. And there is a significant buffering effects of credit access. Credit access helps households to lessen the pressure to rely on child labour when hit by idiosyncratic shocks for children aged 12–14 years while it eases the effect on child labour in case of covariate shocks for adolescents aged 14–17 years.

This study has some limitations worth mentioning. Primarily, the analysis in this paper does not preclude the potential endogeneity of some shocks (for example idiosyncratic shocks). Another limitation is in the analysis is the consideration of only observations with nonzero values, which does not control for sample selection. The bias due to sample selection may not be a

series problem in our study where about three-fourth of the children have non-zero hours of work.

Several sensitivity tests were made to verify stability of the results. Estimated coefficients have proved to be robust to different specifications and sample adjustments.[3] First, analysing the effect of shocks on child work on narrower sample of children aged 7–15 years or on a wider sample of children aged 7–18 years did not bring any significant difference in the results. Second, as a sensitivity analysis, OLS regression[4] is run considering the potential limitations of the Tobit model when estimating the effects of covariates on long-run time use. In terms of sign, the results from OLS regression are similar to the Tobit results. However, there is difference in magnitude: the coefficients from OLS regressions are lower than that of Tobit regressions.

The findings of the paper point to several policy implications. First, the significant effect of shocks on child labour points towards the need to design policies and interventions that would raise household income, enhance resilience and empower households to withstand some shocks without resorting to child labour. For example, measures that improve agricultural practices (such as development of small-scale irrigation systems as well as improved access to disease and drought resistant crop varieties) and/or enhance income-generating capacity of households (such as income diversification opportunities) could mitigate the effects of transitory income shocks. The findings of this paper point to other possible mitigating measures. Non-labour income and access to credit are found to buffer against shocks and reduce the use of child labour. This implies that improved access to credit and non-labour income, along with formal insurance schemes (such as social safety nets and other social protection schemes) could play an important role in reducing the adverse effects of transitory shocks on household income and help prevent households from having to rely on child labour as a coping strategy in the face of shocks.

All in all, our results plea for combination of properly designed policies in the areas of education, social protection, and labour markets. Policies that foster smooth functioning of adult labour markets and help in curbing the

demand for child labour, coupled with efforts to enforce and incentivize schooling of children, say by providing households with incentives to keep children in school (such as a cash transfer programme conditional on children attending school) are likely to be effective tools for reducing child labour.

Notes

[1] Multilevel modelling generates the correct standard errors and efficiently weights the between and within variation to generate the estimated effect based on the residual variances within and between individuals.

[2] *metobit* fits mixed-effects models (fixed effects and random effects) for continuous responses where the outcome variable is censored.

[3] The results from different specifications and sample adjustments are not reported in the current paper. But, they can be presented upon request.

[4] The regression is run focusing solely on working children, allowing for clustering at household level. *meglm* fits mixed-effects models for continuous uncensored response variable. The results are not shown, but are available upon request from the author.

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Appendices

Table A1. Definition of variables and summary statistics on the restricted sample of children, 7 - 17 years

Variable name	Definition	Min	Max
Dependent variables			
Measure of hours of child work			
Weekly_hrs_econ.work	Hours spent in any economic activity (agricultural and/or non-agriculture) during the last seven days	0	70
Daily_hrs_hh.work	Hours and minutes spent on household activities (fetching water and firewood) yesterday	0	6
Explanatory Variables			
I. Variable of interest: *Shock indicators*			
Shock	Dummy=1 if household faced any shocks in the last 12 months; 0 otherwise	0	1
Idiosyncratic_shock	Dummy= 1 if household faced idiosyncratic shocks such as illness/death of member; 0 otherwise	0	1
Covariate_shock	Dummy=1 if household faced any covariate shocks such as flood/drought/ heavy rain; 0 otherwise	0	1
II. Control variables			
Child characteristics			
Boy	Sex of child dummy (=1 if boy; 0 if girl)	0	1
Age	Age of child	0	1
Biological_child	Relation to household head (=1 if child is son/daughter)	0	1
Parent characteristics and household composition			
Male_head	Sex of the household head dummy (=1 if male headed)	0	1

Variable name	Definition	Min	Max
Dependent variables			
Age_head	Age of the household head	18	97
Schooling_head	Years of schooling of household head	0	15
No of infants(<6yrs)	Number of infants in household (under six years)	0	5
No of male adults	Number of male adult members in household (15-65 years)	0	7
No of female adults	Number of female adult members in household (15-65 years)	0	7
Households' wealth/status indicators and potential buffers against shock			
field_size_hec	Land holding (hectares)	0	12.24
Livestock holding	Livestock holding in tropical livestock unit (TLU)	0	38.5
Nonlabor_income	Amount of unearned income	0	42000
Credit_access	Dummy: (1 if household had access to credit last 12 months)	0	1

Table A2. Descriptive statistics of the variables used for the analysis[2]

	Pooled Sample (5181 children)		**Sub sample of children in households that faced shocks (1451 children)**		**Sub sample of children in households that did not face shocks (3730 children)**	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Dependent variables						
Measure of hours of child work (mean hours for all children, including those with zeros work hours)						
Weekly_hrs_econ.work	13.25	17.26	13.70	18.66	13.10	16.75
Daily_hrs_hh.work	0.60	1.05	0.71	1.26	0.57	0.97
Measure of hours of child work (mean hours for working children)						
Weekly_hrs_econ.work	23.46	17.50	24.54	18.91	22.89	16.31
Daily_hrs_hh.work	1.41	1.20	1.71	1.44	1.31	1.10

[2]All the reported statistics are based on the survey design weights included in the data. The weighted sample has 10 strata with 54 Primary Sampling Units (PSUs), where there are different number of observations in each PSU and in each stratum. There are 5181 observations in the PSUs with a minimum of 3, a maximum of 585 and an average of 95.9 observations in the PSUs.

Explanatory variables						
Shock indicator	0.26	0.44				
Idiosyncratic_shock	0.09	0.29	0.34	0.47		
Covariate_shock	0.20	0.40	0.77	0.42		
Boy	0.53	0.50	0.53	0.50	0.52	0.50
Age	11.68	26.00	11.997	2.66	11.57	2.57
Biological_child	0.95	0.23	0.96	0.20	0.94	0.24
Male_head	0.92	0.28	0.91	0.28	0.92	0.27
Age_head	47.01	11.68	48.50	11.94	46.49	11.53
Schooling_head	2.04	2.89	1.73	2.77	2.15	2.93
No of infants(<6yrs)	.73	0.90	0.76	0.93	0.72	0.89
No of male adults	1.64	0.99	1.65	1.00	1.64	0.98
No of female adults	1.55	0.83	1.62	0.84	1.53	0.83
field_size_hec	0.54	0.94	0.56	1.01	0.53	0.91
Livestock holding	1.17	2.37	1.08	2.44	1.21	2.35
Nonlabor_income	229.76	1981.90	315.22	1977.55	199.89	1982.79
Credit_access	0.32	0.47	0.35	0.48	0.31	0.46