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Impact of income and non-income shocks on child labour

Evidence from a panel survey of Tanzania

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Abstract: This paper investigates the impact of income and non-income shocks on child labour using a model in which the household maximizes utility from consumption as well as human capital development of the child. Two types of shocks are considered: agricultural shocks as an income shock and the death of a parent or relatives as a non-income shock. We also investigate if access to credits and household assets act as buffers against transitory shocks. Our results indicate significant effects of crop shocks on child's overall work hours and buffering effects of access to a bank account on child labour and hunger.

Keywords: child labour, buffer stocks, agricultural shocks, consumption smoothing

JEL classification: J82, J22, O13, O16

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1 Introduction

Tanzania has made considerable progress in economic development during the past decade. Average economic growth has been over 7 per cent since 2000. Even during the global economic and financial turbulences it remained robust; real gross domestic product grew by around 6.5 per cent during 2009-11 well above the regional and global averages. Despite this recent progress, poverty remains a critical development challenge in Tanzania, as over a third of the population live below the national poverty line. Rural population, in particular, are trapped in a slow growing agriculture, their mainstay, and thereby in a status of low income. The rural poor are also subject to a plethora of shocks, such as droughts, floods and pest attacks on crops that affect their income. Formal coping mechanisms to shocks such as crop insurance and social protection are either extremely limited or do not exist. Limited household asset holdings and credit constraints also restrain the poor's coping strategies. In such circumstances households tend to use child labour as a buffer against such shocks in smoothing consumption. The use of child labour and child labour bonding is seen in sub-Saharan African countries when households either do not have, or are reluctant to sell, their assets during extreme shocks (Fafchamps 1999). Non-income shocks such as falling sick or the death of the mother or father could have similar effects on their children.

A close relationship between transitory income shocks and child labour has been reported for rural Tanzania (Beegle et al. 2006). This is not surprising given the limited farm income, their exposure to shocks and limited coping arrangements, formal or informal. Child labour, whether it is used as a buffer against household income shocks or a result of non-income shocks, tends to interfere with the development of a child's human capital and the country's development potential. This is particularly relevant, as Tanzania is looking forward to push for a paradigm shift in economic development where human capital will play a critical role.

The objectives of the paper are to examine the relationship between household income and non-income shocks and child labour, and if the availability of other coping strategies such as social protection mechanisms, access to credit or asset holdings reduce child labour. The rest of the paper is organized as follows. Section 2 provides a brief literature review relating to child labour. Section 3 sets out the model. Section 4 describes the data, and outlines the estimation methodology. An analysis of the estimation results is provided in Section 5 along with a robustness check of our results. Section 6 discusses policy implications of findings, and Section 7 concludes.

2 Literature review

There are several underlying factors for the existence of child labour despite it being banned or considered undesirable. The key reasons seem to be poverty, credit market imperfections, imperfect land and labour markets and household characteristics. Basu and Van (1998) pioneered in explaining the economics of child labour. In their model, which depends on a well- functioning labour market, poverty is shown to drive child labour. Households send their children to work only if adult wage falls below a certain point where the household subsistence requirements cannot be met without an alternative source of income. Child labour provides that source (the Luxury Axiom). On the other hand, child labour is considered a substitute for adult labour (Substitution Axiom). Although household survival is the main underlying reason for child labour in this model, it also relates to the permanent income hypothesis and consumption smoothing.

Households can smooth consumption from income variations by depleting or accumulating assets, borrowing or savings, making adjustments to their labour supply or through formal insurance. According to Zeldes (1989), for large enough wealth, consumption is proportional to permanent income and would change only by the annuity value of expected future wealth. Assets

play the role of a buffer stock, absorbing most of the transitory income shocks. Households with a sufficiently high level of assets are able to fully offset the transitory income shocks (Beegle et al. 2006). Sale or purchase of livestock is a primary means through which households smooth their consumption, sometimes selling their livestock to purchase grain instead of eating meat (Sandford 1983). Livestock thus becomes a substitute for insurance (Binswanger and McIntire 1987). In the absence of formal coping strategies such as insurance or assets holdings or access to credit as buffers, households in the presence of shocks tend to use alternative coping mechanisms such as child labour in smoothing consumption (see, for example, Zeldes 1989; Townsend 1994; Chaudhuri and Ravallion 1997; Morduch 1999). While most of these studies support the view that households succeed in smoothing consumption to a certain degree by managing risks, they may not achieve a Pareto efficient level of risk mitigation. Morduch (1999) asserts that while informal insurance mechanisms may be efficient in coping with risks in the right circumstances, they are often weak and costly in the long run.

Credit market imperfections also help explain child labour. Ranjan (2001) shows that credit constraints could lead to child labour as the inability to borrow against labour income could adversely affect consumption. If households can borrow and if education is perceived as profitable, poverty will not be a constraint in sending children to school. Similar results are also found in Baland and Robinson (2000), Dehejia and Gatti (2002) and Beegle et al. (2006). Jacoby and Skoufias (1997) consider seasonal fluctuations in schooling as a form of self-insurance in the face of imperfect credit markets but one which does not result in substantial losses in the accumulation of human capital.

Another strategy is the use of children as insurance. For example, Cain (1982) mentions the role of children as an insurance against unforeseen shocks on household income. A similar approach is taken by Grootaert and Kanbur (1995) who examine how child labour can minimize the risk of temporary shocks to household incomes. Pörtner (2001) shows that children have often been used as insurance against adverse income shocks. In the African context, formal insurance and credit markets, particularly in rural areas, are weak or missing. In such circumstances households tend to smooth their consumption through a variety of informal insurance arrangements.

Child labour can also be linked to the buffer stock literature (Deaton 1992). The riskier the environment, the greater the incentives for households to build buffer stocks which could be utilized at times of shocks. The earning potential of children makes them a valuable asset for households.

Household characteristics are also among the factors that determine child labour. One such factor is parental altruism towards their children. While it is often assumed that parents are altruistic (Basu and Van 1998) and send their children to school, even altruistic parents may resort to child labour in the face of credit constraints (Baland and Robinson 2000), poverty (Basu and Van 1998) and social norms (Emerson and Knabb 2007). If, on the other hand, in situations where parents are non-altruistic or show low level of altruism, child labour may be prevalent. Parental education is another determining factor of child labour. Parents with higher education tend to educate their children rather than sending them to work (Strauss and Thomas 1995).

3 The model

Consider an economy where parents make all the relevant household decisions including those on children's schooling and their participation in the labour market. The household consists of one parent and one child. The household derives utility from consumption and human capital development of the child according to the following function:

$$U(c_{it}, h_{it})_{i,t} = \frac{c_{it}^{\sigma}}{\sigma} + \alpha h_{it} \quad (1)$$

where c_{it} is consumption of household *i* at time *t* and h_{it} is human capital of the child. σ, the elasticity of substitution, and α are constant parameters with $0 < \sigma < 1$ and $\alpha > 0$.

3.1 Households with no asset holdings

We start with a simplified version of the household problem by taking into account some of the features of the Tanzanian rural households. Parents participate fully in the labour market and derive income $f(l_{pit}, \theta_{it})$.

$$f(l_{pit}, \theta_{it}) = w_{pit} l_{pit} + \lambda \theta_{it} + \tau \emptyset_{pit} \quad (2)$$

where w_{pit} is the parent wage rate and l_{pit} the labour input θ_{it} is a transitory random shock and $\emptyset_{pit}$ is a vector of household characteristics, such as parent's education, that affect parent income. λ and τ are constant parameters. The child allocates his time between work (at a wage rate w_{cit}) and schooling. The child's human capital $h_{it} = \beta e_{cit}^{\sigma}$, where β is a technological component and e_{cit} is child's time allocated for schooling (investment in human capital).[1] Initially we assume that households have neither risk free assets nor access to credit.

The household problem is thus given by

$$\max_{c_{it}, e_{cit}} \left\{ \frac{c_{it}^{\sigma}}{\sigma} + \alpha \beta e_{cit}^{\sigma} \right\} \quad (3)$$

Subject to the budget constraint

$$c_{it} = w_{cit}(1 - e_{cit}) + w_{pit} l_{pit} + \lambda \theta_{it} + \tau \emptyset_{pit} \quad (4)$$

Assuming that the ratio between the wage rate of the parent and the child to be constant, and setting child's wage rate as the numéraire, the solution to the first-order conditions from the above household problem can be given by

$$l_{cit} = \delta + \varphi \chi_{pit} + \lambda \theta_{it} + \tau \emptyset_{pit} + \eta e_{cit} + \varepsilon_{it} \quad (5)$$

where χ_{pit} is parent income from labour (farm) and ε_{it} is a random error term with mean zero. δ is a household fixed effects term. According to Equation (5), child labour can be affected by parent income and the child's time allocated for human capital development. Note that parent income could be affected by transitory random shocks such as severe drought or pest attacks which affect their crop production. In the absence of asset holdings, child labour will be the only insurance that acts as a buffer against such shocks in an imperfect credit market setting. We expect higher parent income and investments in human capital development to reduce child

[1] A more generalized form of human capital could be given by $h_{it} = \beta e_{cit}^{\gamma}$, where γ is a constant parameter. We assume $\gamma = \sigma$ for simplicity in the mathematical formulation of the model but it can easily be relaxed.

labour hours and transitory random shocks to increase child labour. As such, we expect $\varphi, \eta < 0$ while $\lambda > 0$.

3.2 Households with asset holdings

Now we relax the above assumption that households have no risk free asset holdings. Liquid asset holdings can exhibit both wealth and substitution effects with respect to child labour depending on the assets' ability to generate income. With this relaxation of the earlier assumption the new household budget constraint is

$$c_{it} = w_{cit}(1 - e_{cit}) + w_{pit}l_{pit} + \lambda\theta_{it} + \tau\emptyset_{pit} + (1 + r)a_{it} - a_{it+1} \quad (6)$$

where r is the rate of interest and a_{it} is the household asset holdings at time t. Regardless of whether the assets are monetary or non-monetary, or whether the assets are sold/disposed of to meet consumption needs in the face of shocks, current period assets could be considered as a function of previous period assets, if the rate of growth (depletion) is assumed to be constant.[2] The solution to the first-order conditions from the household problem under this scenario can be given by

$$l_{cit} = \rho + \varphi\chi_{pit} + \lambda\theta_{it} + \tau\emptyset_{pit} + \eta e_{cit} + \mu a_{it} + u_{it} \quad (7)$$

where ρ is a fixed effects term, μ a constant parameter and u_{it} a random error term. A higher level of household asset holdings is expected to reduce child labour ($\mu < 0$) as parents could use such assets as a buffer stock to minimize the effects of shocks on household consumption.

3.3 Households with asset holdings and access to credit

We further relax the assumption of no access to credit in order to investigate if access to credit reduces child labour. With this relaxation, the budget constraint the household faces can be given as

$$c_{it} = w_{cit}(1 - e_{cit}) + w_{pit}l_{pit} + \lambda\theta_{it} + \tau\emptyset_{pit} + (1 + r)a_{it} - a_{it+1} + b_{it} - (1 + r)b_{it+1} \quad (8)$$

where b_{it} is borrowing at time t at an interest rate r. Note that the model allows the households to borrow while keeping their assets. The solution to the household problem can be given by

$$l_{cit} = \phi + \varphi\chi_{pit} + \lambda\theta_{it} + \tau\emptyset_{pit} + \eta e_{cit} + \mu a_{it} + \vartheta b_{it} + \omega_{it} \quad (9)$$

where $\emptyset$ is the new fixed effects term, ϑ a constant parameter, and ω_{it} a random error term.[3]

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[2] In essence, $\mu = (1 + r) - \frac{1}{\delta}$ where δ is the rate of growth of risk free assets.

[3] $\vartheta = \left(1 - \frac{1+r}{1+\pi}\right)$, where π is the rate of inflation.

4 Data and empirical strategy

4.1 Data set

Overview

This study uses data from two rounds of The Tanzania National Panel Survey (TZNPS). The first round sampled 16,709 individuals in 3,280 households, between October 2008 and October 2009. The second round sampled 20,559 individuals in 3,924 households, between October 2010 and November 2011. Approximately one-third of the sample are urban and two-thirds are rural. The sample includes households from all regions and districts in Tanzania. Over 97 per cent of round 1 households were re-interviewed. Only 7 per cent of household members present in round 1 were missing in round 2. Attrition is thus low, and is not generally associated with the phenomena we study in this paper.[4] We limit our sample to 3,755 children and youth who were of school age in both rounds, i.e., individuals between 7 and 15 years of age during round 1.

Outcome measures

We use as outcomes measures work patterns and human capital development of children in round 2. We use four labour measures: hours worked per (30 day) month for wages, household-run businesses, and household-run farming and hours per month spent on the household tasks of collecting firewood or fuel and water. We find a significant seasonal variation, and accordingly control for seasonality using month fixed effects.

For human capital attainment, we have an indicator variable for current school enrolment as well as one-year-lagged enrolment before each survey round. We use these to construct an indicator for students who had dropped out of school between survey rounds. This amounts to 373 children, nearly 8 per cent of the student sample. As there is significant variation by gender (with a sharper increase among girls rather than boys) we split our main results by gender. Finally, we also use a measure of food security as an outcome. We measure food security using an indicator variable, equalling one if a household answers yes to the question: 'In the last 12 months, have you been faced with a situation when you did not have enough food to feed the household?'

Controls and buffering mechanisms

Controls variables at the child level are limited to age and gender, but since our children's sample is from 692 households, this provides a range of household-level variables such as parental education and household size that we can use as controls. We can also include total value of the land that the family cultivates and consumption per capita in round 1. These are important controls for household income and wealth, i.e., both characteristics are plausibly correlated both with child labour intensity and the prevalence of agricultural shocks. We note significant differences in both these variables between shocked and not-shocked households. This raises the possibility that these differences could in part be due to the agricultural shocks that we are examining and in that sense, these are outcomes rather than controls. Since omitted variable bias is a paramount concern, we ultimately opt to include both as control variables. Furthermore, to the extent that controlling for some of the effect of the shocks bias our results, the bias should be towards zero.

The buffering mechanism we would ideally examine is access to credit, which, of course, is not observed in our data. We use two household-level proxies instead. First, we use an indicator

[4] The one notable exception to this is that hours worked per month is negatively associated with attrition from the sample. No other demographic or labour measures predict attrition from the sample.

variable for families that have a bank account; access to a bank account provides access not only to the ability to save (and self-insure) but also potentially to borrow. Second, we use ownership of durable goods as a proxy for collateralizable assets and hence the ability to borrow; assets can also be used as a buffer stock (i.e., drawn down in response to a shock).

Measuring shocks

Our primary measure of household income shocks is crop shocks. We measure these with an indicator variable to show if a household lost any of its crops after harvest. Rodents, insects or pests are the reason behind 83.86 per cent of these crop losses. In our student sample, 12.36 per cent of the children are drawn from households which were affected by such a shock in the first round.

We also examine the impact of death in the household on child labour and related outcomes. Among all incidents of death we focus on those most likely to be unexpected: sudden death due to illness (death from an illness lasting less than 30 days) and death due to other causes (including traffic accidents, other accidents or injury, childbirth, murder, suicide). These shocks are not as cleanly exogenous as crop shocks, with the possibility of reverse causality and omitted variable bias. Nonetheless, this is an important source of uncertainty for households.

4.2 Empirical strategy

Our empirical strategy is motivated by Equations (5), (7), and (9). We are interested in the relationship between child labour intensity and measures of parental income, crop shocks, and credit constraints. The main challenge in implementing this approach is the potential simultaneity of child labour and parental income. Common local shocks (e.g., weather or local market conditions) could increase both parents' and children's labour hours. A second challenge is the omitted variable bias with respect to crop shocks and child labour. For example, agricultural practices in a region could favour crops that are both more prone to shocks and benefit from greater labour input. Furthermore, crop shocks might be linked to the characteristics of a household that could also lead to increased levels of child labour.

We have a four-fold strategy for addressing these concerns. First, rather than regress child labour on parental labour (or labour income) we use parents' level of education as a proxy for parental income; the advantage of this is that parents' education is predetermined and highly unlikely to be simultaneously determined by child labour. Second, to deal with omitted variable bias we include a broad range of controls, including household controls such as the size of the household and the size of the household's accessible land holdings (to control for differences in household income wealth), along with parental education as mentioned above. Third, we empirically investigate whether household agricultural shocks are correlated with household, child, or parental characteristics. While this does not preclude the possibility of a correlation with unobservable variables, it does increase the plausibility of the view that agricultural shocks are exogenous, effectively random with respect to household labour practices.

Fourth, we also present specifications that include region fixed effects. This allows us to control for all time-invariant unobservables at the regional level that could be correlated with child labour and crop shocks (such as agricultural practices, and also differences in social norms with respect to child labour and the availability of governmental and non-governmental safety nets). At the same time, region fixed effects absorb a significant amount of legitimate variation, for example due to weather shocks at the regional level. As a result, we present both ordinary least squares (OLS) and fixed effects specifications.

Finally, as a robustness check, we exploit the panel structure of the data and present household fixed effects results. By focusing just on the within-household variation this specification controls for a wide range of time-invariant household unobservables. At the same time, the specification also discards more than one-third of the variation in child labour hours, and magnifies the effect of between-child unobservables. With these caveats in mind, we present these results as a robustness check.

5 Estimation results and analysis

5.1 Are shocks exogenous with respect to child labour and transitory?

We begin by investigating whether crop shocks are plausibly exogenous with respect to child labour intensity and other household and individual characteristics. In order to do this, we use a linear probability model to regress crop shocks against our individual, parental, and household control variables.[5] Overall the results lend credence to a causal interpretation of the effect of crop shocks in round 1 on subsequent outcomes, but leave open the interpretation of these results. Any effects we find could be due to incomplete insurance or because some fraction of the sample could be a response to a permanent reduction in household income.

5.2 Child labour and agricultural shocks: direct effects

In this section we examine the direct, reduced-form effect of agricultural shocks on child labour hours, school withdrawal and food security outcomes. We estimate OLS and region fixed effects specifications of Equation (5), with a pooled sample, a boys' sample and a girls' sample. In all tables, direct effect OLS estimates are reported in columns (1), (7) and (13) for the pooled, boys', and girls' samples, respectively. Fixed effects estimates are reported in columns (4), (10) and (16) for the pooled, boys', and girls' samples, respectively.

In Table 1 we begin by looking at the overall work hours as an outcome: total hours spent on wage work, agricultural work, household work and non-paying household-run business work. In column (1) we see that the overall effect of a crop shock is a 7.7 hour increase in child labour hours per month, significant at the 5 per cent level. Relative to the mean of approximately 32 hours in the overall sample, this is approximately a 12 per cent increase in the work hours for children. The inclusion of region fixed effects in column (4) reduces the effect by almost one-third, and it is no longer significant at the standard levels. When we split the sample by gender, we find that the effect for boys is significant and larger in magnitude than the effect for girls, and is significant at the 10 per cent level in the OLS specification. The shock effect on male hours is 9.64 additional hours per month, a 15 per cent increase. The effect on female child labour is not statistically significant.

In Table 2 we turn to agricultural work hours. In the full sample and boys' sample, the effect of a shock on agricultural work hours is significant at the standard levels in the OLS specification and in the full sample also for the fixed effects specification. For girls the effects are not significant at the standard levels. The absolute magnitudes are similar to the overall work hour increase (a seven hour increase in agricultural hours in the pooled sample), although the per cent increase is somewhat larger (a 22 per cent increase in agricultural work hours).

[5] Results are not reported but detailed information is available upon request.

In particular, in Table 3, we examine the impact of agricultural shocks on wage work hours. We find a decrease in wage work hours. This decrease is consistently significant at the 5 per cent level in the pooled sample and the boys' sample. The pooled sample decrease is 2.73 and 3.56 hours in OLS and fixed effects specifications, respectively. This is a 13 to 17 per cent decrease relative to the mean monthly wage work hours. For boys, the OLS and fixed effects reductions are 3.7 and 3.79 hours, respectively, a 17 per cent reduction relative to the boys' mean. Girls also experience a decrease in wage work hours due to crop shocks, although the effect is only significant at the ten per cent level in the fixed effects specification. This fixed effects reduction is 3.34 hours or a 16 per cent decrease.

In Table 4 we look at the effect of agricultural shocks on household work hours: i.e., hours spent fetching water, firewood, and fuel. In the full sample, we find a significant increase (at the 10 per cent level) only in the region fixed effects specification. This is an increase of 3.5 hours, 36 per cent relative to the mean. In the boys' sample, the increase is significant at the 10 per cent level in both OLS and fixed effects specifications. The boys' increase is 42-49 per cent relative to the mean. While girls do spend more time on average engaged in household work, the effect is not statistically significant.

In Table 5, we examine the effect of crop shocks on an indicator for students who left school between survey rounds. We use a linear probability model. Both OLS and fixed effects in the pooled sample show a nearly 4 percentage point increase in children exiting school, significant at the five and one per cent levels, respectively. The effect is large relative to the 6 per cent probability of leaving school for children who did not experience crop shocks (and is about 50 per cent with respect to the overall mean). When we split the sample by gender, we observe that the effect is driven by the girls' sample. For girls the effect is somewhat larger in size compared to the full sample, with the percentage effect being between 71 and 79 per cent. For boys, the effect is only two percentage points in the OLS specification and one percentage point in the region fixed effects specification, with neither coefficient significant at the standard levels.

Finally in Table 6, we examine the effect of crop shocks on food security. For all specifications and samples except the fixed effects specification for girls, we find a positive and statistically significant effect (i.e., an increase in the prevalence of hunger over the year prior to round 2 of the survey). The effect is more than 35 per cent relative to the mean for girls and between 44 and 49 per cent for boys. These results reveal that households are not able to cope fully with the agricultural shocks they face by adjusting children's level of labour hours, i.e., despite working additional hours, children's food security nonetheless suffers.

Overall these results suggest that crop shocks lead not only to an increase in child labour hours but a change in the composition of a child's time use: children are spending less time engaged in wage work and more time in agricultural work, and girls are less likely to be in school.

5.3 Buffering of child labour effects of agricultural shocks

In this section, using the same outcomes examined in the previous section, we examine whether access to credit can buffer the negative impact of agricultural shocks. We consider whether the household has a bank account and a composite measure of durable assets owned by the household, constructed using principal component analysis, as proxies for access to credit. Following Equations (7) and (9), we interact these proxies of access to credit with the crop shock indicator used in the previous analysis, to investigate whether the mechanisms we are investigating mitigate the effect of the shock.

Again, we estimate OLS and region fixed effects specifications, for the pooled, boys', and girls' samples. In Tables 1-6, OLS estimations with the bank account proxy are given in columns (2), (8), and (14) for the pooled, boys', and girls' samples, respectively. Fixed effects estimates for this proxy are in columns (5), (11), and (17) for the pooled, boys', and girls' samples, respectively. OLS estimations with the durable asset index proxy are in columns (3), (9), and (15) for the pooled, boys', and girls' samples, respectively. Fixed effects estimates for this proxy are in columns (6), (12), and (18) for the pooled, boys' and girls' samples, respectively.

Returning to Table 1, we find that the direct effect of a household having a bank account is a reduction of child labour hours, consistent with the model discussed in Section 3. Using the pooled sample, OLS and fixed effects estimates are an 8.89 and a 10.29 hour reduction in child labour hours, respectively. These results are both significant at the 10 per cent level. The magnitude and significance of this coefficient vary in the boys' and girls' samples. Having a bank account mitigates male child labour by 12 hours per month on average in both OLS and fixed effects estimates, although only the former is significant at the 10 per cent level. For the female sample, only the fixed effects estimate is significant at the 10 per cent level, and indicates an 8.5 work hour reduction. At the same time, the interaction effect is not statistically significant. In principle, a buffering effect would correspond to an attenuation of the main crop shock effect. So, for example, in column (14) access to a bank account offsets over half of the main effect of a crop shock on work hours for girls, although the effect is not statistically significant.

In Tables 2-5, the only significant access-to-bank effect is in Table 4, where we find access to a bank significantly and negatively associated with household work hours. The effect is significant in the full sample, but when split by gender, we note that the effect is driven by the girls' sample. The interaction effects are not significant. In Table 6, however, we do find significant buffering effects of access to a bank account on hunger. Both the direct effect of access to banking is significant for most samples and specifications, and the interaction effect is significant in all samples and specifications. The magnitudes of the interaction effects are large, indeed larger than the main effect of crop shocks.

Turning to our second proxy of access to credit, we find that assets, like access to a bank account, are associated with a lower level of overall child labour hours in Table 1. A full standard deviation increase in the asset index (3.5 index points) is associated with a 12 hour decrease in both the OLS and fixed effects specifications. The magnitudes are somewhat larger for girls, for whom the effect is significant at standard levels, and somewhat smaller for boys and not statistically significant. However, the sign of the interaction effect for assets is opposite to what we find for access to a bank account. The effect is positive and significant at the 1 per cent level in the full sample, in both OLS and fixed effects specifications. The mean level of asset holdings magnifies the effect of a crop shock between 13.7 and 17.5 per cent. Comparing the boys' and girls' sample, the interaction effect is somewhat larger in percentage terms for boys than girls and the effect is statistically significant in the latter sample. The differing signs for our two proxies point to a key limitation of the proxies themselves; although both are presumably correlated with the access to credit, both could also be correlated with other variables that could in turn be related to child labour.

The effect of assets on agricultural work hours follows a similar pattern in Table 2, with negative direct effects and positive interaction effects, at least for the significant coefficients in the boys' sample. Tables 3 and 4 show similar patterns for wage and household work hours, although the coefficients are not in general statistically significant. In Tables 5 and 6, for leaving school and hunger, we find negative and statistically significant main effects and insignificant interaction effects.

In conclusion, we find one set of statistically significant buffering effects that go in the direction we expected: access to a bank account seems to buffer children against hunger when households experience agricultural shocks. The buffering effect of this proxy on other outcomes, although not statistically significant, does generally go in the expected direction. However, we also find that household asset holdings magnify, rather than attenuate, the effect of agricultural shocks on children's work hours.

5.4 The effect of death in the household

In this section we examine the impact of another shock—the death of a member of the household—on the same range of child labour, education and food security outcomes. As discussed in Section 4, death of a household member is less likely to be an exogenous shock than a crop shock. Simultaneity is a concern (both child labour and shocks to adult heath can be caused by a contemporaneous negative shock), as is omitted variable bias. Furthermore, death of a household member is by definition a permanent, rather than a transitory, shock. Hence it is also potentially a significant shock to the household's permanent income. As a result, any observed increases in child labour might reflect the household's response to a lower standard of living. At the same time, since death in the household is a significant source of uncertainty, we proceed to examine its effect, bearing these caveats in mind. These results are presented in Table 7.

In panel (a), we observe that a death in the household leads to significant increase in child labour hours in the OLS and region fixed effects specifications for the male sample. The effect is approximately 24 or 25 hours per month or more than 36 per cent relative to the mean. The effect is not statistically significant at the standard levels for girls. In panel (b) we see that the boys' effect is driven by increased agricultural work hours. No other impacts are significant for boys. For girls the only statistically significant impact we find is a reduction in household work hours (significant at the 10 per cent level in the region fixed effects specification in column (6) and more than 40 per cent relative to the mean).

Table 7 also examines the buffering impact of assets on a death in the household (there were no significant buffering effects of the household having a bank account). Most notable is a positive effect of assets interacted with a death in the household on overall and agricultural work hours for boys. This is consistent with our previous finding that assets, although associated with a lower level of work hours, are also correlated with the demand for child labour when households experience shocks. For girls, we find a statistically significant and negative buffering effect of assets on hunger.

5.5 Robustness check: household fixed effects

In Table 8, we present the results from a household fixed effects specification. As discussed in Section 4, this specification focuses just on within-household variation. While these results are less exposed to omitted variables, they also discard some potentially valid variation in child labour hours. The former will lead to less bias, and the latter to less precision in the results.

In Table 8, column (1), the effect of crop shocks on overall child labour hours is, although positive, no longer statistically significant at the standard levels, with a much smaller magnitude than our results in Table 3. Looking within-households, a significant piece of both the variation in child labour hours and the shock is averaged out. This motivates the introduction of the crop shock—age interaction in column (2). It allows us to differentiate the effects of shocks within households by age. We now find a negative and statistically significant shock effect and a positive and statistically significant shock-age interaction. The interaction implies that looking within

households children aged 10.75 or older experience an increase in labour hours (e.g., three hours a month for a 12-year old and 10.5 hours a week for a 15-year old). From the subsequent columns we note that the increase in overall child labour hours is driven by an increase in unpaid work in household businesses. For this category, even the youngest children experience some increase in work hours in response to a shock (1.5 hours a month at age 7 increasing to almost 12.5 hours a month at age 15).

The contrast between the household fixed effects and OLS specifications has several possible interpretations. It could reflect the bias-variation trade-off discussed above (less bias but also less variation in child labour hours) or simply the shorter time elapsed between the shocks and the outcomes. But in part it can also be seen as a characterization of the mechanisms through which crop shocks affect households. While crop shocks lead to a similar overall increase in child labour within and between households, when comparing between-households much of the increase is due to increased agricultural work. But this increase in agricultural work affects all children within the household, and so when that increase is dummied out with household fixed effects, we instead highlight the change in child labour across children within the household, which turns out to be in work hours devoted to household businesses by older children.

6 Policy implications

Child labour is prohibited in most countries. It is also considered undesirable at the societal level. Yet, the practice continues with long-term adverse implications on children, their future and a country's development potential. Our results support earlier observations that factors such as income poverty, credit market imperfections, imperfect asset and labour markets tend to drive this force. So do some household characteristics.

In particular, our results point to several policy implications: (i) the significant effect of income shocks on child labour and the resulting impact on future human capital development, (ii) the possible mitigating measures as indicated by some buffering effects, (iii) the possibilities of using household characteristics such as parental education as a policy instrument in reducing child labour, (iv) the possible adverse gender biases of some coping strategies: girls suffering heavily in the face of household income shocks.

Agriculture is inherently risky but such risks could be managed in several ways. In the sample for Tanzania, over 80 per cent of the crop losses are due to attacks by rodents, insects or pests. Droughts are also a major shock in some regions although not a significant one when taken as a whole. One of the first policy considerations could be to reduce the probability of occurrence of such shocks thereby reducing the magnitude of the adverse effect. Among the risk mitigation measures are the development and improvement of access to disease and drought resistant crop varieties, and development of small-scale irrigation systems. Measures to improve the income generating capacity of households could mitigate the effects of transitory income shocks.

As discussed earlier, our results also indicate the tendency to use child labour as an alternative coping strategy in the presence of shocks to smooth consumption. However, such informal insurance arrangements are inefficient in the long run as they adversely affect human capital development. An effective policy response to minimize such action could be to strengthen access to credit and formal insurance schemes. Contributory agricultural insurance schemes have become important risk mitigation mechanisms against unforeseen crop shocks. The government could also step in to provide re-insurance to insurance schemes operated by the private sector or community groups in order to meet the demand and ensure sustainability.

The fact that household characteristics such as parental education, particularly that of the mother, could reduce the use of child labour as a partial insurance against shocks implies that education of parents could make a difference in child labour outcomes. Our results show gender bias in school attendance when households face income shocks, girls having a larger and significant adverse effect. This is an undesirable outcome not only in terms of efficiency but also on equity. Intergenerational effects of such outcomes through below potential cognition abilities as well as health outcomes of their children are well established. While this happens when social norms and societal biases prevail against girls and require long-term strategies to address them, immediate results could be attained through programmes such as conditional cash transfers when households are faced with transitory income shocks.

7 Conclusion

This study investigated the impact of income and non-income shocks on child labour using data from two rounds of the Tanzania National Panel Survey conducted in 2009 and 2011. Our investigations considered two types of shocks: agricultural shocks as an income shock and the death of parent(s) or relatives as a non-income shock. Our results indicate a significant effect of crop shocks on a child's overall work hours and in agriculture work hours. The effect seems to be higher for boys. For example, the overall effect of a crop shock is a 7.7 hour increase in child labour per month with boys experiencing a 9.6 hour increase (15 per cent). Our investigations show that an increase in agricultural hours is the most important component of the household's response to agricultural shocks. For example, agricultural shocks have an effect of similar magnitude to overall work hours but a larger percentage increase (a 22 per cent increase in agricultural work hours). We also find crop shocks to have a 13-17 per cent drop in wage work hours, with boys experiencing a larger drop (3.8 hours or 17 per cent). Our results also show a significant increase in household work hours due to an agricultural income shock, again boys' household work hours increasing by 42-49 per cent.

An important dimension has been the effect of crop shocks on school attendance. About 50 per cent of students tend to leave school in the face of shocks, with girls having a higher probability of over 70 per cent quitting schooling. This is in contrast to the 6 per cent probability of children in a household not affected by shocks leaving school. Crop shocks also have an effect on food security. The effect is more than 35 per cent relative to the mean for girls and between 44 and 49 per cent for boys. The results indicate that households are not able to fully cope with the agricultural shocks they face by simply resorting to child labour. Food security remains a household problem despite sending children to work for additional hours.

We also examined if access to credit and household assets can act as a buffer against agricultural income shocks. Both access to credit and assets seem to reduce child labour. While having a bank account reduces male child labour by 12 hours, it greatly reduces household work hours of a girl child. We also find significant buffering effects of access to a bank account on hunger. On the other hand, while assets reduce working hours of girls, we do not find it having a significant effect on boys. We also do not see assets acting as a buffer against shocks.

The above findings point to several policy implications. Transitory income shocks tend to drive children to work, be it in the field, home or other work places. This could have serious adverse impact on future human capital development. The results also point to some policy directions as well: increased access to credit and assets could reduce child labour. Parental education could also have a positive effect, thus highlighting the importance of adult education programmes and campaigns to raise awareness. Addressing societal norms and traditions that lead to gender bias in coping strategies in the face of shocks would be useful to make a gender equitable society.

References

Baland, J., and J. Robinson (2000). 'Is Child Labour Inefficient?'. *Journal of Political Economy*, 108(4): 663–79.

Basu, K., and P. Van (1998). 'The Economics of Child Labour'. *American Economic Review*, 88(3): 412–27.

Beegle, K., R. Dehejia, and R. Gatti (2006). 'Child Labour and Agricultural Shocks'. *Journal of Development Economics*, (81): 80–96.

Binswanger, H. P., and J. McIntire (1987). 'Behavioural and Material Determinants of Production Relations in Land-Abundant Tropical Agriculture'. *Economic Development and Cultural Change*, 36(1): 73–99.

Cain, M. (1982). 'Perspectives on Family and Fertility in Developing Countries'. *Population Studies*, 36(2): 159–75.

Chaudhuri, S., and M. Ravallion (1997). 'Risk and Insurance in Village India: Comment'. *Econometrica*, 65(1): 171–84.

Deaton, A. (1992). 'Savings and Income Smoothing in Côte d'Ivoire'. *Journal of African Economies*, 1(1): 1–24.

Dehejia, R., and R. Gatti (2002). 'Child Labour: The Role of Income Variability and Credit Constraints across Countries'. NBER Working Paper 9018. Available at: www.users.nber.org/~rdehejia/papers/dehejia_gatti.pdf

Emerson, P. M., and S. D. Knabb (2007). 'Fiscal Policy Expectation Traps, and Child Labour'. *Economic Inquiry*, 45(3): 453–69.

Fafchamps, M. (1999). 'Rural Poverty, Risks, and Development'. Social Development Paper 144. Rome: FAO.

Grootaert, C., and R. Kanbur (1995). 'Child Labour: An Economic Perspective'. *International Labour Review*, 135(2):187–203.

Jacoby, H., and E. Skoufias (1997). 'Risk, Financial Markets, and Human Capital in a Developing Country'. *Review of Economic Studies*, 64(3): 311–36.

Morduch, J. (1999). 'Between the State and the Market: Can Informal Insurance Patch the Safety Net?'. *World Bank Research Observer*, 2: 157–214.

Pörtner, C. (2001). 'Children as Insurance'. *Journal of Population Economics*, 14(1): 119–36.

Ranjan, P. (2001). 'Credit Constraints and the Phenomenon of Child Labour'. *Journal of Development Economics*, 64: 81–102.

Sandford, S. (1983). *Management of Pastoral Development in the Third World*. New York: John Wiley and Sons.

Strauss, J., and D. Thomas (1995). 'Human Resources: Empirical Modelling of Household and Family Decisions'. In J. Behrman and T. Sirinivasan (eds), *Handbook of Development Economics*, Vol 3. Amsterdam: Elsevier.

Townsend, R. M. (1994). 'Risk and Insurance in Village India'. *Econometrica*, 62(3): 539–91.

Zeldes, S. P. (1989). 'Consumption and Liquidity Constraints: An Empirical Investigation'. *Journal of Political Economy*, 97: 275–98.

Table 1: Total child labour hours (round 2)

	Outcome: Total child labour hours (round 2)																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE
Variables	Full sample						Male						Female					
Crop shock (round 1)	7.686**	7.717**	10.62***	5.389	4.839	8.819**	9.637*	9.606*	13.56**	8.657	8.192	13.27**	5.368	5.645	5.388	1.992	1.527	2.392
	(3.078)	(3.304)	(3.137)	(3.586)	(3.650)	(3.933)	(4.836)	(4.748)	(4.992)	(5.501)	(5.134)	(5.888)	(4.299)	(4.672)	(5.459)	(4.638)	(4.980)	(5.859)
Crop shock x bank account		-0.785			6.103			-0.313			4.430			-3.315			5.283	
		(10.73)			(10.69)			(21.76)			(23.68)			(12.87)			(13.40)	
Bank account (round 1)		-8.888*			-10.29*			-12.52*			-12.12			-6.064			-8.412*	
		(4.338)			(5.007)			(7.254)			(8.181)			(4.278)			(4.850)	
Asset index x crop shock			5.031***			5.348***			8.052**			8.489**			0.991			1.147
			(1.725)			(1.682)			(3.383)			(3.456)			(2.448)			(2.811)
Asset index (round 1)			-3.44***			-3.35***			-2.669			-3.065			-3.96***			-3.544**
			(0.969)			(0.969)			(1.953)			(1.817)			(1.405)			(1.468)
Constant	-4.032	3.733	-3.509	26.10**	25.99*	20.58	-14.03	-18.56	-19.34	14.62	9.877	10.11	13.48	18.98	-3.733	44.14***	34.51***	28.21*
	(12.41)	(11.13)	(11.43)	(9.412)	(13.32)	(13.05)	(18.34)	(18.49)	(14.83)	(24.29)	(24.56)	(19.62)	(13.73)	(12.82)	(14.93)	(13.48)	(12.08)	(15.01)
Observations	2,960	2,959	2,960	2,960	2,959	2,960	1,457	1,457	1,457	1,457	1,457	1,457	1,503	1,502	1,503	1,503	1,502	1,503
R-squared	0.109	0.111	0.115	0.145	0.146	0.150	0.139	0.141	0.145	0.185	0.187	0.191	0.096	0.097	0.103	0.130	0.130	0.135
% main effect	0.117	0.117	0.161	0.0817	0.0734	0.134	0.146	0.146	0.206	0.131	0.124	0.201	0.0814	0.0856	0.0817	0.0302	0.0232	0.0363
t-stat main effect	2.497	2.336	3.387	1.503	1.326	2.242	1.993	2.023	2.716	1.574	1.596	2.254	1.249	1.208	0.987	0.429	0.307	0.408
% interaction effect		-0.102	0.137		1.261	0.175		-0.0326	0.172		0.541	0.185		-0.587	0.0532		3.459	0.139
t-stat interaction		0.0535	44.26		0.205	29.42		0.00636	20.18		0.0642	17.72		0.127	4.828		0.0125	1.877

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

Source: Authors computations.

Table 2: Child agricultural labour hours (round 2)

	Outcome: Child agricultural labour hours (round 2)																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE
Variables	Full sample						Male						Female					
Crop shock (round 1)	7.050**	7.136*	8.540**	5.911*	5.652	7.862**	9.630*	9.829*	12.62**	8.415	8.465	11.78*	4.043	4.054	2.184	3.236	2.805	2.058
	(3.277)	(3.693)	(3.247)	(3.278)	(3.643)	(3.389)	(5.004)	(4.984)	(5.329)	(5.316)	(5.132)	(5.853)	(4.518)	(4.785)	(4.753)	(4.618)	(4.881)	(4.931)
Crop shock x bank account		-1.298			2.930			-2.739			-1.152			-0.394			4.687	
		(10.44)			(10.29)			(18.19)			(19.42)			(10.01)			(9.479)	
Bank account (round 1)		-6.318			-6.023			-8.355			-7.283			-4.783			-4.943	
		(3.750)			(4.280)			(5.966)			(6.414)			(3.326)			(3.864)	
Asset index x crop shock			2.550			3.046			6.271*			6.344*			-1.926			-1.255
			(2.016)			(1.992)			(3.483)			(3.587)			(1.470)			(1.657)
Asset index (round 1)			-1.72**			-1.69**			-1.491			-1.723			-1.859*			-1.610
			(0.744)			(0.702)			(1.903)			(1.723)			(0.985)			(1.087)
Constant	5.067	10.14	7.052	13.87*	19.79	17.40	1.035	-2.125	-1.420	12.30	9.168	10.49	5.417	10.11	-3.268	9.619	18.63	1.613
	(9.275)	(11.45)	(10.89)	(7.110)	(13.82)	(13.12)	(16.50)	(16.45)	(12.20)	(21.35)	(21.49)	(16.84)	(9.365)	(11.36)	(10.79)	(9.885)	(11.69)	(12.31)
Observations	2,960	2,959	2,960	2,960	2,959	2,960	1,457	1,457	1,457	1,457	1,457	1,457	1,503	1,502	1,503	1,503	1,502	1,503
R-squared	0.109	0.110	0.112	0.143	0.144	0.145	0.120	0.122	0.125	0.165	0.167	0.171	0.102	0.103	0.107	0.135	0.136	0.139
% main effect	0.219	0.222	0.266	0.184	0.176	0.245	0.300	0.306	0.393	0.262	0.263	0.367	0.126	0.126	0.0680	0.101	0.0873	0.0641
t-stat main effect	2.151	1.933	2.630	1.803	1.552	2.320	1.925	1.972	2.368	1.583	1.650	2.013	0.895	0.847	0.459	0.701	0.575	0.417
% interaction effect		-0.182	0.0863		0.518	0.112		-0.279	0.144		-0.136	0.156		-0.0972	-0.255		1.671	-0.176
t-stat interaction		0.0905	17.50		0.130	19.49		0.0826	19.01		0.0259	17.10		0.0165	0.631		0.0616	0.586

Note: Robust standard errors in parenth*** p<0.01, ** p<0.05, * p<0.10

Source: Authors computations.

Table 3: Child wage labour hours

	Outcome: Child wage labour hours (round 2)																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE
Variables	Full sample						Male						Female					
Crop shock (round 1)	-2.728**	-2.65**	-2.576**	-3.57**	-3.779**	-3.335**	-3.69**	-3.41**	-3.51**	-3.78**	-3.67**	-3.41**	-1.788	-1.931	-1.649	-3.343*	-3.884**	-3.243*
	(1.201)	(1.120)	(1.138)	(1.463)	(1.357)	(1.470)	(1.516)	(1.633)	(1.436)	(1.659)	(1.746)	(1.580)	(1.434)	(1.316)	(1.323)	(1.751)	(1.514)	(1.634)
Crop shock x bank account		-0.773			2.204			-3.289			-1.264			1.672			5.397	
		(4.498)			(4.690)			(2.682)			(3.047)			(9.003)			(8.987)	
Bank account (round 1)		2.141			1.401			0.0970			0.493			3.603			2.679	
		(1.870)			(1.927)			(2.849)			(2.836)			(3.186)			(3.275)	
Asset index x crop shock			0.310			0.364			0.239			0.530			0.383			0.281
			(0.368)			(0.423)			(0.550)			(0.685)			(0.555)			(0.452)
Asset index (round 1)			-0.776***			-0.774***			-0.738**			-0.766**			-0.843***			-0.848***
			(0.228)			(0.212)			(0.293)			(0.308)			(0.275)			(0.217)
Constant	-12.00***	-3.314	-6.525	-0.407	3.156	0.228	-8.880	-9.020	-10.92	3.476	3.589	1.619	-8.806*	0.542	-12.42**	2.673	1.256	-1.137
	(3.380)	(6.262)	(6.193)	(3.733)	(4.366)	(4.497)	(6.317)	(6.653)	(6.508)	(6.749)	(7.010)	(7.152)	(4.569)	(8.006)	(4.831)	(4.588)	(5.746)	(4.757)
Observations	2,960	2,959	2,960	2,960	2,959	2,960	1,457	1,457	1,457	1,457	1,457	1,457	1,503	1,502	1,503	1,503	1,502	1,503
R-squared	0.028	0.028	0.029	0.049	0.050	0.051	0.043	0.043	0.044	0.068	0.068	0.069	0.027	0.028	0.028	0.051	0.052	0.053
% main effect	-0.128	-0.125	-0.121	-0.168	-0.178	-0.157	-0.174	-0.160	-0.165	-0.178	-0.173	-0.161	-0.0840	-0.0907	-0.0775	-0.157	-0.182	-0.152
t-stat main effect	2.272	2.366	2.263	2.444	2.784	2.268	2.438	2.089	2.445	2.285	2.106	2.163	1.246	1.467	1.246	1.909	2.565	1.985
% interaction effect		0.292	-0.0348		-0.583	-0.0316		0.964	-0.0197		0.344	-0.0448		-0.866	-0.0672		-1.390	-0.0250
t-stat interaction		0.101	21.80		0.363	19.79		0.807	10.24		0.421	13.12		0.0413	6.209		0.252	16.62

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Source: Authors computations.

Table 4: Child chore labour hours

	Child chore labour hours (round 2)																
	(1)	(2)	(3)	(4) Region FE	(5) Region FE	(6) Region FE	(7)	(8)	(9)	(10) Region FE	(11) Region FE	(12) Region FE	(13)	(14)	(15)	(16) Region FE	(17) Region FE
Variables	OLS	OLS	OLS				OLS	OLS	OLS				OLS	OLS	OLS		
	Full sample						Male						Female				
Crop shock (round 1)	3.266	2.938	3.880*	3.550*	3.308	4.118*	3.816*	3.251	4.057*	4.462*	3.920	4.727**	2.527	2.613	3.350	2.202	2.412
	(1.924)	(2.189)	(1.958)	(2.041)	(2.302)	(2.035)	(2.189)	(2.600)	(1.971)	(2.441)	(2.893)	(2.237)	(2.331)	(2.818)	(3.007)	(2.456)	(2.971)
Crop shock x bank account		3.525			2.674			6.405			6.125			-1.114			-1.835
		(4.262)			(4.097)			(7.832)			(8.158)			(6.352)			(6.485)
Bank account (round 1)		-3.61***			-4.08***			-1.832			-2.028			-5.11***			-5.89***
		(1.198)			(1.260)			(1.678)			(1.940)			(1.512)			(1.525)
Asset index x crop shock			1.040			0.885			0.450			0.374			1.217		
			(1.393)			(1.378)			(1.103)			(1.166)			(2.652)		
Asset index (round 1)			-0.580			-0.605			-0.364			-0.550			-0.674		
			(0.388)			(0.383)			(0.505)			(0.552)			(0.468)		
Constant	9.978**	5.365	4.913	19.84***	12.30***	12.04***	0.583	0.262	-0.328	6.808	6.412	5.471	23.85***	16.70***	21.20***	39.29***	24.56***
	(4.174)	(3.579)	(4.323)	(3.926)	(3.256)	(4.257)	(4.343)	(4.616)	(4.840)	(5.071)	(5.326)	(5.366)	(5.887)	(5.667)	(7.164)	(5.854)	(5.798)
Observations	2,960	2,959	2,960	2,960	2,959	2,960	1,457	1,457	1,457	1,457	1,457	1,457	1,503	1,502	1,503	1,503	1,502
R-squared	0.045	0.046	0.046	0.061	0.062	0.062	0.034	0.035	0.035	0.059	0.060	0.060	0.033	0.035	0.034	0.061	0.065
% main effect	0.357	0.321	0.424	0.388	0.361	0.450	0.417	0.355	0.443	0.487	0.428	0.516	0.276	0.285	0.366	0.240	0.263
t-stat main effect	1.697	1.342	1.981	1.739	1.437	2.023	1.743	1.250	2.058	1.828	1.355	2.113	1.084	0.927	1.114	0.897	0.812
% interaction effect		1.200	0.0775		0.808	0.0621		1.970	0.0320		1.563	0.0229		-0.426	0.105		-0.761
t-stat interaction		0.249	7.272		0.281	6.685		0.150	4.439		0.177	4.129		0.103	3.061		0.202

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Source: Authors computations.

Table 5: Child left school between rounds

	Outcome: Child left school between rounds																
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE
Variables	Full sample						Male						Female				
Crop shock (round 1)	0.0398**	0.0443***	0.0331*	0.0394***	0.0419**	0.0369**	0.0235	0.0262	0.0216	0.0112	0.0105	0.00971	0.0567**	0.0621**	0.0520*	0.0624***	0.0688***
	(0.0143)	(0.0151)	(0.0163)	(0.0141)	(0.0151)	(0.0171)	(0.0202)	(0.0211)	(0.0187)	(0.0202)	(0.0219)	(0.0188)	(0.0220)	(0.0239)	(0.0270)	(0.0220)	(0.0238)
Crop shock x bank account		-0.0520			-0.0288			-0.0323			0.00334			-0.0634			-0.0698
		(0.0309)			(0.0299)			(0.0335)			(0.0368)			(0.0435)			(0.0441)
Bank account (round 1)		-0.0149			-0.0198			-0.0384			-0.0364			-0.00137			-0.0105
		(0.0172)			(0.0189)			(0.0249)			(0.0303)			(0.0225)			(0.0237)
Asset index x crop shock			-0.0107			-0.00444			-0.0144			-0.0109			-0.00200		
			(0.0132)			(0.0139)			(0.0181)			(0.0197)			(0.0160)		
Asset index (round 1)			-0.012***			-0.01***			-0.014**			-0.0123**			-0.0116**		
			(0.00409)			(0.00398)			(0.00616)			(0.00574)			(0.00438)		
Constant	-0.19***	-0.203***	-0.239***	-0.131**	-0.139**	-0.171***	-0.20***	-0.21***	-0.26***	-0.0826	-0.0937	-0.146	-0.235***	-0.23***	-0.286***	-0.253***	-0.260***
	(0.0488)	(0.0515)	(0.0552)	(0.0502)	(0.0542)	(0.0597)	(0.0642)	(0.0672)	(0.0730)	(0.0993)	(0.103)	(0.112)	(0.0569)	(0.0591)	(0.0669)	(0.0765)	(0.0810)
Observations	2,463	2,462	2,463	2,463	2,462	2,463	1,189	1,189	1,189	1,189	1,189	1,189	1,274	1,273	1,274	1,274	1,273
R-squared	0.091	0.092	0.097	0.116	0.116	0.120	0.085	0.087	0.093	0.138	0.139	0.143	0.109	0.109	0.113	0.133	0.134
% main effect	0.501	0.557	0.417	0.497	0.528	0.465	0.296	0.330	0.271	0.141	0.133	0.122	0.714	0.782	0.655	0.786	0.866
t-stat main effect	2.787	2.934	2.025	2.806	2.780	2.155	1.167	1.244	1.154	0.555	0.481	0.516	2.575	2.601	1.928	2.833	2.893
% interaction effect		-1.174	-0.0934		-0.687	-0.0348		-1.231	-0.194		0.316	-0.324		-1.021	-0.0111		-1.014
t-stat interaction		3.628	4.214		1.850	2.408		0.838	2.728		0.0210	0.473		2.837	1.304		3.156

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10
Source: Authors computations.

Table 6: Insufficient food situation in past 12 months

Outcome: Insufficient food situation in past 12 months (round 2)																			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE	OLS	OLS	OLS	Region FE	Region FE	Region FE	Region FE
Variables	Full sample						Male						Female						
Crop shock (round 1)	0.0723***	0.0920***	0.0481	0.0714**	0.0895**	0.0519	0.0831**	0.103**	0.0665*	0.0923**	0.112**	0.0785*	0.0665*	0.0857**	0.0357	0.0657	0.107	0.0842*	0.0377
	(0.0258)	(0.0289)	(0.0362)	(0.0312)	(0.0336)	(0.0431)	(0.0343)	(0.0379)	(0.0359)	(0.0411)	(0.0434)	(0.0453)	(0.0350)	(0.0374)	(0.0457)	(0.0387)	(0.0856)	(0.0418)	(0.0515)
Crop shock x bank account		-0.225***			-0.196***			-0.23***			-0.23***			-0.21***				-0.18***	
		(0.0347)			(0.0288)			(0.0531)			(0.0441)			(0.0482)				(0.0538)	
Bank account (round 1)		-0.0707**			-0.086***			-0.0558			-0.0657			-0.085**				-0.098**	
		(0.0275)			(0.0287)			(0.0373)			(0.0401)			(0.0357)				(0.0411)	
Asset index x crop shock			-0.0370			-0.0315			-0.0429**			-0.0366			-0.0330				-0.0321
			(0.0230)			(0.0251)			(0.0196)			(0.0217)			(0.0312)				(0.0342)
Asset index (round 1)			-0.026***			-0.027***			-0.026***			-0.028***			-0.026***				-0.025***
			(0.00543)			(0.00581)			(0.00750)			(0.00661)			(0.00735)				(0.00810)
Constant	0.345***	0.245***	0.176***	0.421***	0.253***	0.184***	0.208*	0.176	0.120	0.230	0.185	0.136	0.328***	0.274***	0.203*	0.408***	0.284***	0.252**	0.275***
	(0.0439)	(0.0658)	(0.0553)	(0.0620)	(0.0717)	(0.0546)	(0.118)	(0.127)	(0.102)	(0.149)	(0.168)	(0.130)	(0.0992)	(0.0844)	(0.104)	(0.0747)	(0.0862)	(0.0907)	(0.0837)
Observations	2,960	2,959	2,960	2,960	2,959	2,960	1,457	1,457	1,457	1,457	1,457	1,457	1,503	1,502	1,503	1,503	1,502	1,502	1,503
R-squared	0.029	0.037	0.043	0.060	0.068	0.073	0.038	0.045	0.053	0.088	0.096	0.102	0.030	0.040	0.044	0.063	0.064	0.073	0.076
% main effect	0.381	0.485	0.253	0.376	0.472	0.273	0.438	0.544	0.351	0.486	0.589	0.413	0.350	0.451	0.188	0.346	0.565	0.443	0.198
t-stat main effect	2.800	3.184	1.328	2.293	2.667	1.204	2.421	2.726	1.853	2.244	2.580	1.731	1.900	2.291	0.781	1.701	1.254	2.013	0.732
% interaction effect		-2.449	-0.222		-2.188	-0.175		-2.276	-0.186		-2.074	-0.135		-2.517	-0.267		-0.606	-2.179	-0.247
t-stat interaction		9.025	2.735		5.630	2.425		9.101	7.365		5.653	6.935		4.018	0.914		1.914	3.835	0.813

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Source: Authors computations.

Table 7: The Impact of deaths on child labour outcomes

	(1)	(2)	(3)	(4)	(5)	(6)		(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Region FE	OLS	Region FE	OLS	Region FE		OLS	Region FE	OLS	Region FE	OLS	Region FE
Variables	Full sample	Full sample	Male	Male	Female	Female	Variables	Full sample	Full sample	Male	Male	Female	Female
A. Total work hours							B. Farm work hours						
Household death round 2	9.845	8.644	25.30**	23.80**	-3.943	-4.157	Household death round 2	13.98	13.43	26.78**	26.50**	2.554	2.347
	(9.657)	(8.847)	(11.38)	(10.84)	(7.791)	(6.785)		(9.751)	(9.423)	(11.16)	(11.03)	(7.025)	(6.767)
Index of HH assets owned x Household death round 2	9.749**	9.949**	16.01***	16.31***	1.475	1.460	Index of HH assets owned x Household death round 2	9.044**	8.784**	15.17***	14.98***	1.032	0.750
	(3.741)	(3.758)	(4.033)	(4.153)	(4.593)	(4.557)		(3.405)	(3.324)	(3.952)	(3.928)	(2.643)	(2.727)
Index of HH assets owned	-3.190***	-3.029***	-2.088	-2.446	-4.011***	-3.540**	Index of HH assets owned	-1.699**	-1.547**	-1.109	-1.326	-2.105**	-1.758*
	(1.026)	(1.006)	(2.055)	(1.920)	(1.326)	(1.332)		(0.811)	(0.733)	(1.982)	(1.814)	(0.843)	(0.914)
Constant	-15.28	16.96	-17.07	12.49	-2.290	29.56*	Constant	-0.548	9.945	0.499	12.20	-2.993	2.401
	(14.47)	(11.04)	(16.75)	(23.90)	(15.38)	(15.47)		(10.30)	(6.826)	(14.28)	(20.60)	(10.70)	(11.88)
Observations	2,960	2,960	1,457	1,457	1,503	1,503	Observations	2,960	2,960	1,457	1,457	1,503	1,503
R-squared	0.114	0.150	0.146	0.193	0.103	0.135	R-squared	0.113	0.147	0.130	0.176	0.106	0.138
% main effect	0.149	0.131	0.384	0.361	-0.0598	-0.0630	% main effect	0.435	0.418	0.834	0.825	0.0795	0.0731
t-stat main effect	1.019	0.977	2.222	2.195	0.506	0.613	t-stat main effect	1.434	1.425	2.399	2.403	0.364	0.347
% interaction effect	0.286	0.333	0.183	0.198	-0.108	-0.102	% interaction effect	0.187	0.189	0.164	0.163	0.117	0.0924
t-stat interaction	5.169	3.690	31.28	26.69	0.593	0.718	t-stat interaction	22.17	21.18	58.44	60.08	0.644	0.520
C. Wage work hours							D. Household work hours						
Household death round 2	-0.609	-0.827	2.761	2.295	-3.134	-3.340	Household death round 2	-3.317**	-3.601**	-3.102	-2.721	-3.359	-3.934*
	(2.071)	(2.098)	(3.731)	(3.875)	(2.061)	(2.100)		(1.292)	(1.372)	(2.003)	(1.917)	(2.296)	(2.264)
Index of HH assets owned x Household death round 2	-0.0527	0.455	0.673	1.285	-0.752	-0.418	Index of HH assets owned x Household death round 2	-0.0107	-0.0643	-0.230	-0.287	-0.0485	-0.00919
	(0.676)	(0.840)	(0.695)	(1.069)	(1.564)	(1.641)		(0.758)	(0.812)	(0.692)	(0.719)	(1.764)	(1.743)
Index of HH assets owned	-0.733***	-0.763***	-0.737**	-0.782**	-0.789***	-0.821***	Index of HH assets owned	-0.500	-0.532	-0.291	-0.455	-0.611	-0.533
	(0.228)	(0.233)	(0.288)	(0.302)	(0.249)	(0.202)		(0.496)	(0.501)	(0.460)	(0.510)	(0.698)	(0.690)
Constant	-15.67***	-4.605	-11.88*	0.715	-12.57**	-1.954	Constant	8.930	19.40***	0.800	6.820	22.17***	38.43***
	(3.848)	(4.371)	(6.356)	(6.958)	(4.754)	(4.643)		(5.910)	(5.605)	(5.144)	(5.973)	(7.872)	(7.539)
Observations	2,960	2,960	1,457	1,457	1,503	1,503	Observations	2,960	2,960	1,457	1,457	1,503	1,503
R-squared	0.028	0.049	0.042	0.067	0.028	0.051	R-squared	0.044	0.060	0.031	0.055	0.033	0.062
% main effect	-0.0286	-0.0389	0.130	0.108	-0.147	-0.157	% main effect	-0.362	-0.393	-0.339	-0.297	-0.367	-0.430
t-stat main effect	0.294	0.394	0.740	0.592	1.521	1.590	t-stat main effect	2.567	2.625	1.549	1.420	1.463	1.738

% interaction effect	0.0250	-0.159	0.0704	0.162	0.0694	0.0362	% interaction effect	0.000928	0.00516	0.0215	0.0305	0.00417	0.000675
t-stat interaction	0.192	1.233	3.422	1.375	2.606	1.619	t-stat interaction	0.213	1.222	5.366	5.488	0.182	0.0412
	(1)	(2) Region FE	(3) OLS	(4) Region FE	(5) OLS	(6) Region FE		(1) OLS	(2) Region FE	(3) OLS	(4) Region FE	(5) OLS	(6) Region FE
Variables	Full sample	Full sample	Male	Male	Female	Female	Variables	Full sample	Full sample	Male	Male	Female	Female
E. Left school between rounds							F. Experienced hunger						
Household death round 2	0.0442	0.0411	0.0775	0.0653	0.0341	0.0285	Household death round 2	0.00345	-0.0171	0.0425	0.0101	-0.0269	-0.0547
	(0.0403)	(0.0407)	(0.0478)	(0.0437)	(0.0447)	(0.0467)		(0.0573)	(0.0572)	(0.0825)	(0.0906)	(0.0477)	(0.0474)
Index of HH assets owned x Household death round 2	0.00480	0.00845	0.0362	0.0469**	-0.0134	-0.0112	Index of HH assets owned x Household death round 2	-0.0339	-0.0393	-0.0283	-0.0298	-0.0395	-0.0610*
	(0.0115)	(0.0108)	(0.0215)	(0.0223)	(0.0210)	(0.0209)		(0.0298)	(0.0305)	(0.0378)	(0.0404)	(0.0311)	(0.0342)
Index of HH assets owned	-0.0135***	-0.0124***	-0.0170**	-0.0149**	-0.0118**	-0.0116**	Index of HH assets owned	-0.0297***	0.0299***	-0.0299***	-0.0309***	0.0295***	-0.0283***
	(0.00434)	(0.00419)	(0.00645)	(0.00608)	(0.00430)	(0.00506)		(0.00671)	(0.00717)	(0.00754)	(0.00699)	(0.00820)	(0.00879)
Constant	-0.233***	-0.164***	-0.260***	-0.124	-0.277***	-0.287***	Constant	0.227***	0.300***	0.133	0.152	0.212*	0.295***
	(0.0554)	(0.0585)	(0.0715)	(0.0989)	(0.0699)	(0.0911)		(0.0504)	(0.0724)	(0.111)	(0.141)	(0.107)	(0.0887)
Observations	2,463	2,463	1,189	1,189	1,274	1,274	Observations	2,960	2,960	1,457	1,457	1,503	1,503
R-squared	0.095	0.118	0.093	0.145	0.110	0.132	R-squared	0.038	0.069	0.045	0.093	0.040	0.073
% main effect	0.557	0.517	0.976	0.822	0.429	0.358	% main effect	0.0182	-0.0898	0.224	0.0533	-0.142	-0.288
t-stat main effect	1.096	1.009	1.623	1.496	0.763	0.609	t-stat main effect	0.0601	0.298	0.516	0.112	0.565	1.153
% interaction effect	0.0313	0.0594	0.135	0.208	-0.114	-0.113	% interaction effect	-2.847	0.666	-0.192	-0.852	0.425	0.322
t-stat interaction	5.163	6.985	17.90	10.99	3.402	2.625	t-stat interaction	0.00131	0.109	1.422	0.0163	0.509	2.479

Source: Authors computations.

Table 8: Household fixed effects specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12=
	Monthly labour hours	Monthly labour hours	Monthly HH farm work hrs	Monthly HH farm work hrs	Monthly wage hours	Monthly wage hours	Monthly unpaid HH bus work hrs	Monthly unpaid HH bus work hrs	Chore hours	Chore hours	In school	In school
Variables	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Crop shock	1.276	-26.64*	-3.945	-14.12	0.316	1.946	7.327**	-8.087	-2.533	-6.870	0.0208	0.0165
	(6.043)	(15.79)	(3.361)	(9.918)	(1.216)	(4.231)	(3.404)	(8.264)	(2.236)	(5.929)	(0.0252)	(0.0808)
Age x crop shock		2.474*		0.903		-0.145		1.368*		0.384		0.000380
		(1.440)		(0.927)		(0.426)		(0.756)		(0.478)		(0.00807)
Age	7.755***	7.399***	3.788***	3.659***	1.012***	1.033***	2.048***	1.852***	0.885***	0.830***	-0.0539***	-0.0539***
	(0.482)	(0.479)	(0.336)	(0.332)	(0.196)	(0.207)	(0.263)	(0.264)	(0.190)	(0.204)	(0.00308)	(0.00321)
Observations	5,860	5,860	5,870	5,870	5,870	5,870	5,870	5,870	5,860	5,860	5,305	5,305
R-squared	0.113	0.114	0.048	0.048	0.021	0.021	0.222	0.223	0.009	0.009	0.183	0.183
Number of households	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,467	1,467
% main effect	0.0261	-0.544	-0.249	-0.891	0.125	0.771	0.366	-0.404	-0.240	-0.650	0.0237	0.0188
t-stat main effect	0.211	1.687	1.174	1.424	0.260	0.460	2.152	0.979	1.133	1.159	0.826	0.205
% interaction effect		-1.059		-0.729		-0.848		-1.929		-0.638		0.262
t-stat interaction		19.01		7.519		1.227		1.652		5.181		0.00565

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Source: Authors computations.