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Health Shocks and Child Time Allocation Decisions by Households: Evidence from Ethiopia

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Health Shocks and Child Time Allocation Decisions by Households: Evidence from Ethiopia

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Abstract

Little is currently known about the effects of shocks to parental health on the allocation of children's time between alternative activities. Using longitudinal data from the Ethiopian Young Lives surveys of 2006 and 2009, we analyze the effect of health shocks on the amount of children's time spent in work, leisure and education. We find that paternal illness increases the time spent in income-generating work but maternal illness increases the time spent in domestic work. Moreover, maternal illness has a relatively large effect on daughters while paternal illness has a relatively large effect on sons. Overall, parental illness leads to large and significant increases in the amount of child labour as defined by UNICEF.

Key words: parental illness; child labour; Ethiopia

JEL classification: D13; I12; I21; O15

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1. Introduction

Parents typically care somewhat about their children. However, there is some opportunity cost in allocating children's time to activities which enhance child welfare, such as education and play. This opportunity cost is likely to be higher when the parents' capacity to generate income is lower, so negative household income shocks can be expected to reduce children's education and play time and increase their work time (Basu & Van, 1998; Baland & Robinson, 2000; Ranjan, 1999). Evidence for such an effect has been found in studies of agricultural productivity shocks (Beegle *et al*., 2006; Colmer, 2013; Guarcello *et al*., 2008) and of employment shocks (Duryea *et al*., 2007; Guarcello *et al*., 2010). Fallon & Tzannatos (1998) and Udry (2006) argue that child labour is principally a result of chronic poverty, and there is some evidence for such a link from cross-country studies (Edmonds & Pavcnik, 2005), country-specific studies (ILO, 2013b; Jensen & Nielsen, 1997; Edmonds, 2005), and cash transfer experiments (Edmonds, 2006; Edmonds & Schady, 2009; Skoufias *et al*., 2001; Bourguignon *et al*., 2003).[1]

This paper focuses on the effects on children's time allocation of shocks to parental health. Health shocks are among the most costly causes of economic hardship in developing countries: ill health can lead to large out-of-pocket expenses as well as reducing household labour supply and income (McIntyre *et al*., 2006; Mendola *et al*., 2007; Sparrow *et al*., 2014; Wagstaff, 2007). Parental health shocks could have a particularly large effect on children's time, because a child is required not only to provide a substitute for adult labour but also to care for the parent. The child's education could be adversely affected because the household can no longer afford to pay for it, or because the child has no time to study (Haile & Haile, 2012; Rosati &

[1] However, in some environments the link between household wealth and the incidence of child labour is somewhat complex: see Bhalotra and Heady (2003) and Basu *et al*. (2010).

Rossi, 2001; Rosenzweig & Evenson, 1977; Udry, 2006), or because the child is fatigued by strenuous or hazardous employment (Duryea *et al*., 2007; Heady, 2003).

To our knowledge there is only one existing study of the effect of parental illness on child labour and education: Dillon (2012). This seminal paper does have some limitations: in particular, it focuses on all child work, including time spent on innocuous household chores and light work as well as child labour as defined by organisations such as the International Labour Organization (ILO) and the United Nations Children's Emergency Fund (UNICEF). Depending on their age and the type of task they perform, children might benefit from light work: they might acquire skills useful in future life or earn income that can help to finance their own education and health (Cigno & Rosati, 2002; Moehling, 2005). If we are interested primarily in child labour as defined by the ILO and UNICEF – i.e. work that is harmful to the child's wellbeing and personal development – then the classification of all child work as child labour constitutes measurement error. Moreover, Dillon's reliance on cross-sectional data makes it difficult to allow for unobserved heterogeneity at the household level (e.g. for parents who put little value on human capital and so invest in neither their own health nor their children's education).

Our study uses longitudinal data for two cohorts of children in the Ethiopian Young Lives surveys of 2006 and 2009. We estimate the impact of parental health shocks on the allocation on children's time in a way that allows for a distinction between child work and child labour. This distinction is based on the definition of child labour developed by UNICEF (United Nations, 1989), which is consistent with the guidelines in the ILO's Minimum Age Convention (ILO, 1973) and the resolutions of the 18th International Conference of Labour Statisticians (ILO, 2008). This definition takes into account work intensity and the child's age**.** We also distinguish

between the effects of paternal and maternal illness, and between the effects on sons and the effects on daughters. Our results are based on fixed effects estimates that allow for unobserved heterogeneity.

We find that parental illness has a large and statistically significant effect on the allocation of children's time, but that there are large asymmetries between maternal and paternal illness. Paternal illness reduces time spent in school while increasing time spent in income-generating work, but maternal illness reduces time spent in play and income-generating work while increasing time spent in domestic work. Moreover, maternal illness has a larger impact on daughters while paternal illness has a larger impact on sons. In this way, the effects of parental illness appear to reflect traditional gender roles within the household. There is also some heterogeneity in the effects of parental illness on the prevalence of child labour. Overall, serious maternal illness is associated with a ten percentage point increase in prevalence while serious paternal illness has a smaller effect. However, maternal illness has a relatively large effect on prevalence among girls and paternal illness a relatively large effect on prevalence among boys.

Section 2 of the paper provides some background information about Ethiopia. Section 3 introduces the data analyzed in sections 4, and section 5 concludes.

2. Country Background

Despite high rates of economic growth in recent decades, Ethiopia remains one of the poorest countries in the world (Seyoum, 2013; World Bank, 2015b). The Ethiopian adult literacy rate is about 50%, and Ethiopia has one of the lowest school enrolment rates in Sub-Saharan Africa; it also has one of the highest rates of prevalence of child labour (ILO, 2013a). Although there is little gender disparity in educational outcomes, rural areas continue to lag behind urban areas on indicators such as school enrolment: see Figures 1-2.

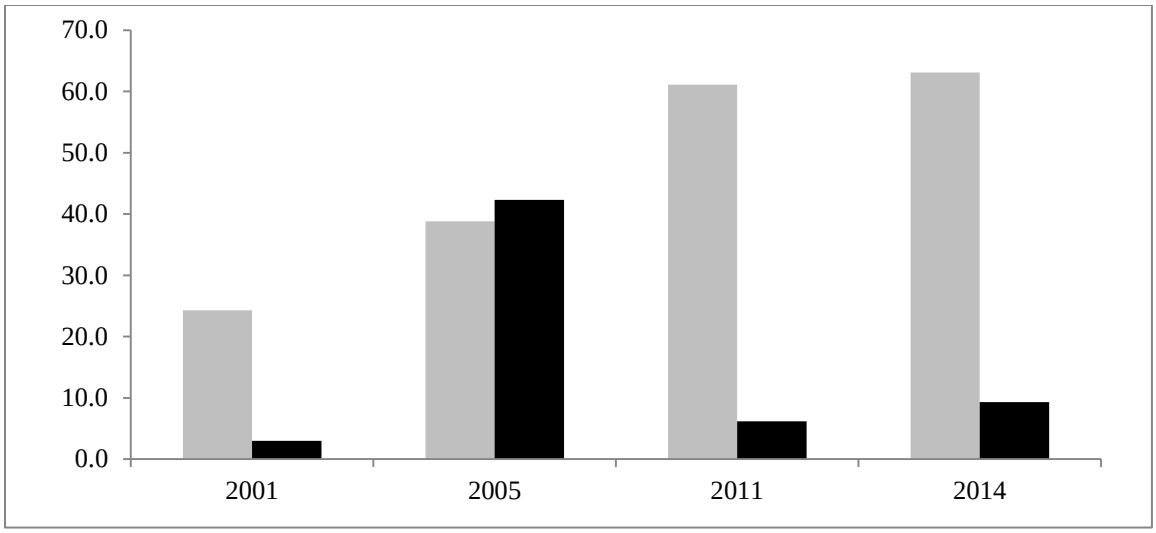

Figure 1. Rural net attendance ratios for primary education (▒) and secondary education (■)

Source: Central Statistical Agency Demographic and Health survey (various years)

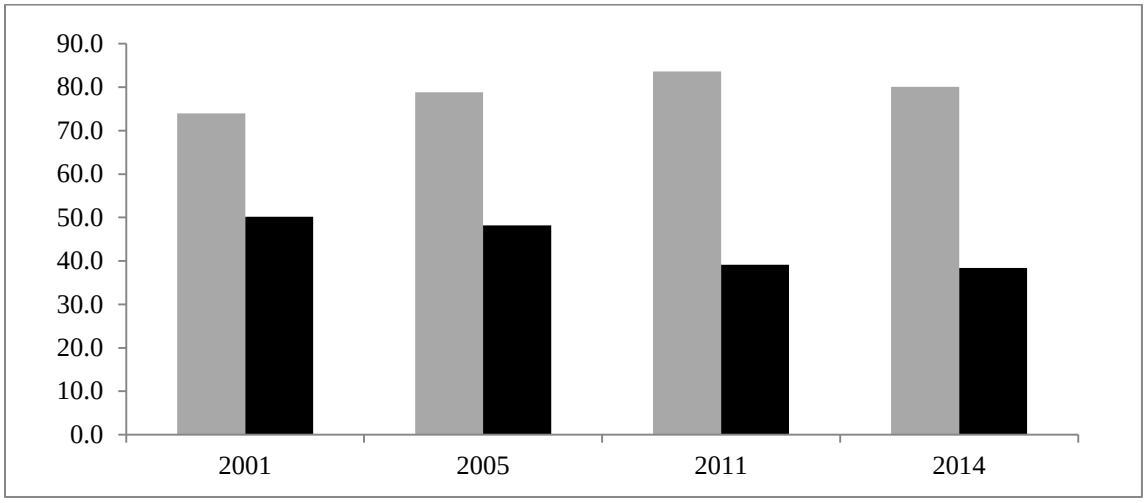

Figure 2. Urban net attendance ratios for primary education (▒) and secondary education (■)

Source: Central Statistical Agency Demographic and Health survey (various years)

These low enrolment rates correspond to a high prevalence of child labour, which persists despite Ethiopia's ratification of the International Labour Organisation conventions on child labour and their incorporation into law (Federal Negarit Gazeta, 2004). Surveys indicate that

despite improvement over the last two decades, a large proportion of Ethiopian children are engaged in some form of child labour, i.e. work deemed harmful for the child's development: see Table 1.[2] Current prevalence rates are somewhat higher for boys than for girls. Although paid employment for children is rare, many households rely on children to work in the house or on the family farm. In rural areas, children's work on the farm is a particularly important way of maintaining household income (Admassie, 2003; Guarcello & Rosati, 2007).

Table 1. The prevalence of child labour in Ethiopia

	2001	2011
full sample	55%	35%
boys	62%	49%
girls	42%	32%
urban	40%	39%
rural	49%	16%

Source: CSA and CIF International (2012); Central Statistical Authority of Ethiopia (2001)

One potential cause of child labour is parental illness. Access to healthcare remains limited in many areas of Ethiopia: for example, the average clinic serves about 20,000 people and the average general hospital about 1.25 million people (World Bank, 2015a); there are only about 20 nurses and three physicians for every 100,000 people. Moreover, there are substantial regional inequities in the distribution of healthcare services: for example, three states (Oromia, Amhara and the Southern Nations and Nationalities Region) account for 80% of the Ethiopian

[2] The definition of child labour is discussed in more detail below; these figures are based on the UNICEF definition.

population but only 38% of Ethiopian physicians (World Health Organisation, 2013). In addition, a large proportion of healthcare expenses are borne by households rather than by the state, and few households have access to health insurance, so in 2014 78% of out-of-pocket healthcare expenses were paid directly by households; this compares with a Sub-Saharan average of 60% (World Bank, 2016). These expenses deter households from seeking care: recent data indicate that 40% of the population do not seek care when they are ill, of whom 25% cite the cost of treatment as a reason (Federal Ministry of Health, 2014).

As a consequence, illness is one of the major drivers of poverty in Ethiopia (Dercon *et al*., 2005). For example, Cropper *et al*. (2000) estimate that a single incidence of malaria results in loss of between 12 and 26 working days, while the treatment cots amount to between 5% and 8% percent of a household's annual income. Such diseases lead to significant reductions in household expenditure (Asfaw & von Braun, 2004; Dercon & Krishnan, 2000). Previous studies have shown that households have a variety of ways of coping with health shocks. For example, Dercon and Krishnan (2000) find that women sometimes cut their own food consumption for the sake of other household members, while Yilma *et al*. (2014) find that households liquidate financial assets and borrow from friends and relatives. In this paper we explore an alternative coping strategy: increasing the work time of the household's children.

3. Data and Descriptive Statistics

Our data are taken from the Ethiopian Young Lives surveys of 2006 and 2009 (www.younglives.org.uk/content/ethiopia). As with Young Lives surveys in other countries, the Ethiopian sample comprises two cohorts of children in a stratified sample of villages: one cohort was aged 0.5-1.5 years in 2002 while the other was aged 7.5-8.5 years in 2002. Before attrition, the younger cohort comprised 2,000 children and the older cohort 1,000 children. After attrition

due to mortality and other factors,[3] and after excluding children aged under five or living in single-parent households at the time of the survey, we have sample sizes of 1,299 and 970 respectively. Note that only one child is sampled in each household, so there is no distinction between child fixed effects and household fixed effects. Unlike most household surveys, Young Lives gathers information on children's time allocation; this information is based on interviews with the children themselves.

Table 2 provides summary statistics for children's daily time allocation between play, schooling (including homework), domestic chores and income-generating work in the two rounds of the survey. Income-generating work includes activities such as street vending, work on the farm or serving in the family store. Domestic chores include activities such as washing, cooking, cleaning and caregiving; these definitions are consistent with those of the United Nations (2009). The table shows a marked upward trend in schooling time and downward trend in play time; this corresponds to an increase in the school enrolment rate from 56% in 2006 to 85% in 2009. There is also a substantial percentage increase in income-generating work time. On average, income-generating work only makes up a small proportion of children's time – much less than time spent on domestic chores – but the low mean is accompanied by a high standard deviation, so there are some children who are spending a substantial proportion of their time in income-generating work.

Table 2 also shows some gender asymmetries. Although boys and girls spend roughly the same amount of time on average in play, schooling and work, the girls' work time is much more dominated by domestic chores while boys spend a substantial amount of time in income-generating work. This may reflect cultural norms relating to gender roles: there are some

[3] Outes-Leon and Dercon (2008) find that the attrition is purely random.

domestic chores that would not normally be expected of boys (e.g. cooking), and it might sometimes be unacceptable for a girl to leave the home unaccompanied. It remains to be seen whether these differences lead to asymmetries in the effects of parental illness.

Table 2. Child hours allocated to alternative activities

2006 Survey Round	play	schooling	domestic chores	income-generating work	*sample size*
total mean hours	6.40	4.40	2.82	1.00	
std. dev.	4.12	4.01	1.89	1.84	*2,269*
prevalence of non-zero hours	100%	57%	90%	30%	
boys mean hours	6.55	4.30	2.53	1.34	
prevalence of non-zero hours	100%	56%	90%	38%	*1,204*
girls mean hours	6.24	4.51	3.14	0.61	
prevalence of non-zero hours	100%	58%	91%	23%	*1,065*
2009 Survey Round	play	schooling	domestic chores	income-generating work	*sample size*
total mean hours	3.78	6.60	3.01	1.61	
std. dev.	2.18	3.03	1.89	2.38	*2,269*
prevalence of non-zero hours	100%	87%	96%	43%	
boys mean hours	3.91	6.51	2.91	2.36	
prevalence of non-zero hours	100%	86%	93%	57%	*1,204*
girls mean hours	3.62	6.68	3.82	0.75	
prevalence of non-zero hours	100%	88%	99%	27%	*1,065*

Neither of the work categories in Table 2 corresponds to standard definitions of child labour. In this paper, we will analyze both the work categories in Table 2 and child labour as

defined by UNICEF. For children aged 5-11 years, child labour is defined as domestic chores in excess of 28 hours per week 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; for children aged 15-17 years, child labour is defined as work of any kind in excess of 42 hours per week. Using this definition, Table 3 reports prevalence rates for child labour in our Ethiopian sample; it indicates that about half of all Ethiopian children participate in child labour to some degree, though there were not any substantial changes in the prevalence of child labour between the two surveys.

Table 3. Prevalence of **c**hild labour

	2006 Survey Round			**2009 Survey Round**		
	boys	*girls*	*total*	*boys*	*girls*	*total*
prevalence rate	56%	54%	55%	53%	54%	54%

Our aim is to measure the extent to which the variation in these data can be explained by parental illness. Table 4 provides summary statistics for the incidence of maternal and paternal illness for the 2,269 children in our sample. These figures indicate the proportion of children whose mothers or fathers report having been ill in the three years prior to the survey.[4] In both surveys, the incidence of maternal illness is higher than the incidence of paternal illness; moreover, the incidence of paternal illness is the same across the two surveys while the incidence of maternal incidence has risen. These asymmetries will matter if the effects of parental illness

[4] Evidence from previous studies suggests that self-reported measures of illness are a reliable indicator of the individual's true health status. For example, Butler *et al*. (1987), Rosen & Taubman (1982) and Kruk *et al*. (2009) find a strong correlation between self-reported measures and objectives measure of health status.

are gender-specific. In estimating the effects of parental illness we will need to control for other negative shocks to the household that could conceivably lead to more child labour: illness among other members of the household, the death of livestock, crop failure, theft, the loss of paid employment and forced eviction. Three-year incidence rates for these shocks are also reported in Table 4. Other control variables in our model include measures of the age and highest school grade previously attained by the child, the child's mother and the child's father; whether the child has a step-mother or step-father; the household's size, wealth level and access to risk-sharing institutions;[5] the sex of the household head and a household power index for the mother; the local community's level of access to healthcare and microfinance services; the incidence of community-level droughts and floods, and whether the community is rural or urban. Definitions and summary statistics for these variables appear in the appendix.

Table 4. Incidence rates for negative shocks to the household

	2006 Survey Round	**2009 Survey Round**		**2006 Survey Round**	**2009 Survey Round**
maternal illness	28%	35%	*illness of another person*	25%	29%
paternal illness	22%	21%	*loss of paid employment*	10%	11%
crop failure	21%	26%	*forced eviction*	3%	4%
theft	13%	10%	*death of livestock*	25%	30%

[5] These institutions are the *iddir*, *eqqub* and *debbo*. The *iddir* is a funeral association with contributions that fund expenses when a family member dies; in recent years, *iddirs* have started making loans or grants to members experiencing other types of shock that entail a loss of income. The *eqqub* is a rotating credit and saving association which can prioritise payments to members facing financial difficulties. The *debbo* is an agricultural labour sharing arrangement that can provide extra help to members who are ill (Hoddinott *et al*., 2005; Krishnan & Sciubba, 2009).

4. Modelling the Determinants of Child Work and Child Labour

4.1. Modelling child work

The first part of our empirical analysis involves estimation of the determinants of the number of hours of a child's time that are allocated to the different activities in Table 2. Given the large number of children with zero time allocated to schooling, household chores or income-generating work, our estimates are based on a Fixed Effects Poisson model with errors clustered at the community level.[6] For each activity *j*, the dependent variable (y_{ijt}) is the amount of time that child *i* records spending on that activity in survey round *t*. This variable is assumed to have a Poisson distribution with a mean equal to:

$$\mathrm{E}(y_{ijt}) = \exp\left(\gamma_{1j} h_{it}^{m} + \gamma_{2j} h_{it}^{f} + x_{it}'\beta_j + \eta_{ij}\right) \qquad (1)$$

Here, h_{it}^{m} and h_{it}^{f} are indicator variables for the incidence of paternal and maternal illness in the previous three years, x_{it} is a vector comprising the control variables listed above, and η_{ij} is a child-specific fixed effect; the β and γ terms are parameters to be estimated. This model is fitted first of all to the full sample of 2,269 children aged 5-17 years, except in the case of schooling, where we exclude children aged 5-6 years from the sample because the first year of Ethiopian primary education is for children aged 7-8 years.[7]

Table 5 includes estimates of the γ parameters in equation (1); estimates of the β parameters appear in the appendix, along with a discussion of the effects of the control variables.

[6] Poisson models can be appropriate for continuous variables that include zero observations, as long as the conditional mean equation is correctly specified (Manning & Mullahy, 2001; Mihaylova *et al.*, 2011; Wooldridge, 2010).

[7] Note also that an observation of zero hours in both survey rounds will be perfectly predicted by the fixed effect, so such observations are excluded from the sample. This means that in most cases the reported sample sizes are somewhat smaller than the total of 2 × 2,269 = 4,538.

Given the functional form of equation (1), the γ parameter estimates can be interpreted as the percentage change in the number of hours worked, on average, in the case of maternal or paternal illness. The table indicates marked asymmetries between the effects of maternal and paternal illness. Maternal illness is associated with a 30% increase in the amount of time spent on domestic chores; correspondingly, there is a 10% reduction in the amount of time spent in play and a 17% reduction in the amount of time spent in income-generating work; all of these effects are significant at the 5% level. The estimated effect of maternal illness on time in school is very small and insignificantly different from zero. Paternal illness is associated with a 28% increase in the amount of time spent in income-generating work; correspondingly, there is a 9% reduction in the amount of time spent in school; both of these effects are significant at the 1% level. The effects on maternal illness on domestic chore time and of paternal illness on income-generating work time are unsurprising, given the traditional gender roles of adults in most Ethiopian households (Haile & Haile, 2012). However, it is more surprising that only paternal illness reduces time in school. One possible explanation is that the extra income-generating work resulting from paternal illness takes up whole days of a child's time, making it impossible to go to school; the extra domestic chores resulting from maternal illness might more easily be fitted around the school day.

Table 6 includes estimates of the γ parameters in equation (1) when the model is fitted to a sample of boys only and a sample of girls only. The table shows marked asymmetries in the effects of parental illness on girls and boys. For boys, the effects of paternal illness are similar to (but somewhat larger than) the aggregate effects in Table 5: when his father is ill, a boy can be expected to spend 29% more time in income-generating work and 14% less time in school. However, the estimated effects of paternal illness on girls are all much smaller and

insignificantly different from zero. By contrast, the effects of maternal illness are larger for girls than for boys: the increase in girls' domestic chore time is 31% (versus 26% for boys) and the reduction in girls' play time is 12% (versus 8% for boys). The most marked asymmetry in the effect of maternal illness relates to income-generating work time, which falls by 34% for girls but only 8% for boys: it seems that whatever income-generating work girls are doing can be sacrificed if the mother needs more help in the home, but this is not the case for boys.

Table 5. The Effects of parental illness on time spent in different activities

	play	*schooling*	*domestic chores*	*income-generating work*
maternal illness	–0.098**	–0.033	0.299**	–0.170*
	(0.025)	(0.024)	(0.025)	(0.071)
paternal illness	0.045	–0.092**	0.012	0.276**
	(0.027)	(0.031)	(0.027)	(0.071)
observations	*4,538*	*1,908*	*4,514*	*2,334*

Standard errors appear in parentheses. A double asterisk (**) beside a parameter indicates that it is significantly different from zero at the 1% level; a single asterisk (*) indicates significance at the 5% level. The parameters indicate the percentage change in the number of hours worked, on average, in the case of maternal or paternal illness.

Overall, the traditional gender roles among adults seem to correspond to similar roles among children. These results are consistent with those of existing studies of gender-specific substitution between adult labour and child labour. For example, Goldin (1979) finds a high degree of substitution between mothers' labour and daughters' labour in household production in nineteenth-century America. Similarly, Skoufias (1993) finds that rises in the adult female wage

rate lead to reductions in girls' school attendance, suggesting that the higher wage rate encourages households to keep the girl at home to perform household work while the mother goes out to earn a wage.

Table 6. The Effects of parental illness on time spent in different activities (sub-samples)

sub-sample	*effect*	*play*	*schooling*	*domestic chores*	*income-generating work*
boys	*maternal illness*	–0.079* (0.035)	–0.049 (0.045)	0.263** (0.042)	–0.084 (0.081)
	paternal illness	0.063 (0.038)	–0.141** (0.054)	0.057 (0.043)	0.290** (0.078)
girls	*maternal illness*	–0.117** (0.035)	–0.073 (0.043)	0.313** (0.029)	–0.344* (0.141)
	paternal illness	0.025 (0.038)	0.019 (0.048)	–0.016 (0.033)	0.143 (0.160)

Standard errors appear in parentheses. A double asterisk (**) beside a parameter indicates that it is significantly different from zero at the 1% level; a single asterisk (*) indicates significance at the 5% level. The parameters indicate the percentage change in the number of hours worked, on average, in the case of maternal or paternal illness.

4.2. Modelling child labour

The second part of our empirical analysis involves estimation of the determinants of the prevalence of child labour. The harm to individual children from being subjected to child labour will depend on a number of factors, including both the total number of labour hours and the type of work involved. Measuring the extent of harm is a topic for future research, and here we follow

previous studies (Baland & Robinson, 2000; Basu & Van, 1998; Beegle *et al*., 2006; Ranjan, 1999) in focussing on a binary variable (z_{it}) which indicates whether child *i* is subjected to any child labour in survey period *t*. Assume that the data generating process for z_{it} takes the form of a Fixed Effects Probit model:

$$\mathrm{P}(z_{it} = 1) = \Phi\left(\alpha_1 h_{it}^{m} + \alpha_2 h_{it}^{f} + x_{it}^{'}\varphi + \mu_i\right) \tag{2}$$

Here $\Phi(.)$ is the cumulative normal density function, μ_i is a child-specific fixed effect, and the other variables are as in equation (1). Although this model cannot be estimated directly, consistent estimates of the α and φ parameters can be obtained by replacing μ_i with a linear function of the child-specific mean values of h_{it}^{m}, h_{it}^{f} and x_{it} plus a random effect $\varepsilon(i)$:

$$\begin{aligned} &\mathrm{P}(z_{it} = 1) = \Phi\left(\alpha_1 h_{it}^{m} + \alpha_2 h_{it}^{f} + x_{it}^{'}\varphi + \pi_1 \bar{h}_i^{m} + \pi_2 \bar{h}_i^{f} + \bar{x}_i^{'}\omega + \varepsilon(i)\right) \\ &\varepsilon(i) \sim \mathrm{N}\left(\delta,\, \sigma^2\right) \end{aligned} \tag{3}$$

This model can be fitted using a Random Effects Probit estimator, and is known as a "Correlated Random Effects" model (Wooldridge, 2011). In Table 6 we report estimates from such a model, but for comparison also include estimates from a simple Random Effects model in which the π and ω parameters are set to zero.

Table 7 reports the average partial effects of maternal and paternal illness on the probability of child labour, i.e. $\Phi'(.)\cdot\alpha_1$ and $\Phi'(.)\cdot\alpha_2$ evaluated at the mean value of $\Phi(.)$, along with the corresponding standard errors. The table also reports estimates of the standard deviation of the random effect, σ. Estimates of the other parameters in the model are available on request. It can be seen that the Correlated Random Effects (CRE) and Random Effects (RE)

estimates are quite similar, although the restrictions implicit in the latter can be rejected at the 1% level using a χ^2 test. Maternal illness has a relatively large effect on the probability of child labour: in the CRE model this probability is estimated to increase by about ten percentage points when the mother is ill, an effect that is significant at the 1% level. The effect of paternal illness is very much smaller and in the CRE model is insignificantly different from zero.

Table 7. Average partial effects of illness on the probability of child labour

	RE Probit Model	**CRE Probit Model**
maternal illness	0.132** (0.014)	0.096** (0.020)
paternal illness	0.034* (0.017)	0.020 (0.023)
σ	0.114** (0.043)	0.141** (0.043)
observations	4,538	4,538

Standard errors appear in parentheses. A double asterisk (**) beside a parameter indicates that it is significantly different from zero at the 1% level; a single asterisk (*) indicates significance at the 5% level. The parameters indicate the percentage change in the probability of child labour in the case of maternal or paternal illness.

The asymmetry in the effects of maternal and paternal illness is somewhat surprising: one might have expected the father's illness to increase child labour through its effect on household income (Basu & Van, 1998; Fallon & Tzannatos, 1998; Udry, 2006). However, it is consistent with the results regarding child time allocation discussed above. Maternal illness mainly affects time spent on domestic chores while paternal illness mainly effect time spent in income-

generating work. The percentage increase in domestic chores following maternal illness is approximately equal to the percentage increase in income-generating work following paternal illness (see Table 5), but the average amount of time spent in domestic chores is much higher than the average amount of time spent in income-generating work (see Table 2). Therefore, maternal illness is associated with larger absolute increases in total child work time, and is more likely to take the child's work hours over the threshold that defines child labour.

One possible reason for the relatively large absolute effects of maternal illness is that there is a greater degree of substitutability between children's labour and women's labour than there is between children's labour and men's labour, either for cultural reasons or because men's labour often requires upper body strength that children lack, whereas women's labour involves stamina that children do have. In the appendix, we explore this idea further by looking at the effects of illness on household consumption. We show that paternal illness leads to a significant reduction in household expenditure. This suggests that the average household's response to paternal illness is a combination of reduced spending and a moderate increase in the children's income-generating work time: the consumption financed by the marginal hour which a healthy father spends in income-generating work seems not to be essential. However, the results in the appendix also show that maternal illness leads to no significant reduction in household expenditure. The lost maternal labour hours are probably mainly in domestic chores, but the household does not respond by reducing paternal income-generating work time and the consumption it finances: rather, the children must make up for the mother's lost hours.

Table 8 shows average partial effects from the CRE model fitted to girl-only and boy-only sub-samples. It can be seen that the effect of maternal illness on girls is much larger than that on boys. On average, maternal illness raises the probability of child labour for girls by 13

percentage points (an effect significant at the 1% level) and the probability of child labour for boys by only five percentage points (an effect not quite significant at the 5% level). In contrast, paternal illness raises the raises the probability of child labour for boys by seven percentage points (an effect significant at the 5% level) while having no significant impact on girls. Taken together, the results in Tables 6 and 8 suggest that girls' labour is a very close substitute for women's labour but no substitute for men's labour, while boys' labour is a moderately close substitute for both men's and women's labour.

Table 8. Average partial effects of illness on the probability of child labour (sub-samples)

	boys	*girls*
maternal illness	0.050 (0.028)	0.132** (0.029)
paternal illness	0.072* (0.030)	-0.032 (0.034)

Standard errors appear in parentheses. A double asterisk (**) beside a parameter indicates that it is significantly different from zero at the 1% level; a single asterisk (*) indicates significance at the 5% level. The parameters indicate the percentage change in the probability of child labour in the case of maternal or paternal illness.

5. Summary and Conclusion

Health shocks are among the most unpredictable and costly causes of economic hardship in developing countries. When a family member is ill, households face loss of income and large, out-of-pocket payments for medical care. This paper contributes to the growing body of evidence that many households cope with such shocks by reallocating the time of family members (Gertler

& Gruber, 2002; Wagstaff, 2007). Our contribution is to show that in at least one country – Ethiopia – health shocks have a large effect on the allocation of children's time.

Our results are based on estimates from fixed effects models applied to longitudinal data from the Ethiopian Young Lives survey. We find that paternal illness reduces children's time spent in school and increases their time spent in income-generating work, while maternal illness reduces time spent in play and increases time spent in domestic work. Maternal illness has a relatively large effect on girls while paternal illness has a relatively large effect on boys, which suggests that the allocation of both adult and child time is influenced by traditional gender roles. Moreover, parental illness has significant effects on the prevalence of child labour, i.e. the proportion of children engaged in work detrimental to their personal development. Here the effects of maternal illness are larger than those of paternal illness, which reflects the fact that maternal illness has a relatively large absolute effect on the number of hours that children work.

These results suggest that existing studies may underestimate the size of the association between household welfare and child labour. Measures of welfare are often based on poverty indices related to household income or wealth, and these measures are more strongly correlated with the income-generating work of men than with the domestic work of women in traditional societies. Negative shocks to the supply of labour for domestic work can nevertheless lead to substantial reductions in household welfare, and Ethiopian households' coping strategy for such shocks seems to entail effects on children that are at least as large as the effects of lost income-generating capacity through paternal illness. A further implication is that when estimating the return to public investment in adult (and particularly women's) health, it is important to account for the effect of adult health on children's time allocation.

Finally, while acknowledging that the potential benefits of publicly funded healthcare or health insurance programmes, such schemes will not fully mitigate the impact of maternal illness on child labour unless households can find someone else to do the housework. Some households might be able to rely on extended family members or friends to help out when the mother is ill, but others will have to buy in help; this means that development outcomes for many children will depend crucially on the efficiency of the market for domestic help.

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APPENDIX

A1. Definitions and Summary Statistics for the Additional Control Variables

Table A1 provides summary statistics for the additional control variables in the model. These variables are defined as follows.

Child Characteristics

- *highest grade* is the highest school grade completed by the child.
- *child age* is the child's age in years
- *female* equals one if the child is a girl, and zero otherwise.

Parental Characteristics

- *mother's education* is the highest school grade completed by the mother.
- *biological mother* equals zero if the child's mother is the biological mother, and zero otherwise.
- *mother's age* is the mother's age in years.
- *father's education* is the highest school grade completed by the father.
- *biological father* equals zero if the child's father is the biological father, and zero otherwise.
- *father's age* is the father's age in years.

Household Characteristics

- *mother's power* is an index of the relative influence of the mother in household decision-making.
- *male head* equals one if the household head is male, and zero otherwise.
- *household size* is the number of people in the household.
- *wealth index* is the household wealth index described in Woldehanna *et al*. (2008).

Table A1. Summary statistics for the additional explanatory variables

	2006 Survey Round		**2009 Survey Round**	
	mean	*std. dev.*	*mean*	*std. dev.*
Child Characteristics				
highest grade	1.35	1.92	2.77	2.80
child age	8.24	3.34	11.16	3.34
female	0.53	0.50	0.53	0.50
Parental Characteristics				
mother's education	2.11	3.58	2.27	3.51
biological mother	0.86	0.35	0.81	0.39
mother's age	34.9	8.5	37.7	8.4
father's education	2.77	4.16	2.95	4.10
biological father	0.69	0.46	0.62	0.49
father's age	43.9	10.9	46.6	10.9
Household Characteristics				
mother's power	0.46	0.28	0.46	0.28
male head	0.78	0.41	0.77	0.42
household size	6.25	2.06	6.25	2.05
wealth index	0.29	0.17	0.34	0.17
owns animal	0.65	0.48	0.71	0.45
land size	0.70	1.19	0.98	7.24
member of social group	0.74	0.44	0.73	0.44
Community Characteristics				
urban	0.40	0.49	0.41	0.49
microfinance	0.71	0.45	0.72	0.45
health centre	0.86	0.34	0.86	0.35
drought events	0.40	0.49	0.40	0.49
flood events	0.36	0.48	0.56	0.50
Observations	*2,269*		*2,269*	

• *owns animal* equals one if the household owns any livestock, and zero otherwise.

• *land size* is the surface area of the household's land, in hectares.

• *member of social group* equals one if the household is a member of one of the social groups described in footnote 5 above, and zero otherwise.

Community Characteristics

• *urban* equals one if the community in an urban area, and zero otherwise.

• *microfinance* equals one if there is a microfinance organisation in the community, and zero otherwise.

• *health centre* equals one if there is a health centre in the community, and zero otherwise.

• *drought events* equals one if the community has experienced a drought in the last three years, and zero otherwise.

• flood events equals one if the community has experienced a flood in the last three years, and zero otherwise.

A2. The Full Set of Parameter Estimates in the Table 5 Model

Table A2 corresponds to Table 5 of the main text but includes the estimated effects of all of the explanatory variables in the model. Among the statistically significant effects, it can be seen that the existing education level of the child (*highest grade*) is positively associated with current time in school and negative associated with time spent in income-generating work, while older children spend more time in income-generating work but also more time in play. A child living with its biological mother can be expected to spend less time in domestic chores but more time in income-generating work, while a child living with its biological father can be expected to spend less time in income-generating work and more time in other activities. The mother effect might

Table A2. Estimated effects of all variables on time spent in different activities

	play	*schooling*	*domestic chores*	*income-generating work*
mother ill	–0.098**	–0.033	0.299**	–0.170*
	(0.025)	(0.025)	(0.025)	(0.071)
father ill	0.045	–0.091**	0.012	0.276**
	(0.027)	(0.032)	(0.027)	(0.071)
highest grade	0.019	0.039*	0.024	–0.098**
	(0.017)	(0.021)	(0.018)	(0.034)
child age	0.221*	0.085	0.333	0.122**
	(0.133)	(0.261)	(0.238)	(0.495)
(*child age*)^2	0.017**	–0.011	0.000	–0.017**
	(0.001)	(0.008)	(0.001)	(0.002)
mother's education	–0.040*	0.004	0.017	0.099
	(0.018)	(0.017)	(0.023)	(0.088)
biological mother	0.027	0.115	–0.405**	0.429**
	(0.045)	(0.042)	(0.037)	(0.141)
mother's age	–0.001	–0.001**	–0.003	0.005
	(0.004)	(0.005)	(0.005)	(0.016)
father's education	0.049**	–0.015	0.003	–0.090
	(0.017)	(0.012)	(0.018)	(0.064)
biological father	0.144**	0.273**	0.164**	–0.874**
	(0.035)	(0.048)	(0.036)	(0.069)
father's age	–0.007*	0.001	–0.002	0.021
	(0.003)	(0.004)	(0.003)	(0.010)
mother's power	0.367	–0.044	0.233	–1.167*
	(0.247)	(0.225)	(0.252)	(0.560)
male head	–0.097*	–0.139*	–0.049	0.477**
	(0.046)	(0.058)	(0.057)	(0.144)
household size	–0.012	–0.006	0.001	–0.038
	(0.010)	(0.009)	(0.011)	(0.028)

Standard errors appear in parentheses. A double asterisk (**) beside a parameter indicates that it is significantly different from zero at the 1% level; a single asterisk (*) indicates significance at the 5% level.

Table A2 (Continued).

	play	*schooling*	*domestic chores*	*income-generating work*
wealth index	0.000	0.181	–0.050	–0.603
	(0.131)	(0.112)	(0.149)	(0.408)
owns animal	0.081*	0.007	–0.033	0.315
	(0.038)	(0.034)	(0.037)	(0.205)
land size	0.001	–0.001**	0.005*	–0.001
	(0.001)	(0.000)	(0.002)	(0.001)
urban	0.075	–0.137	–0.002	–0.074
	(0.078)	(0.087)	(0.086)	(0.323)
illness of another person	0.004	0.004	–0.049	0.108
	(0.023)	(0.023)	(0.027)	(0.064)
crop failure	–0.027	–0.023	–0.008	0.082
	(0.026)	(0.028)	(0.026)	(0.058)
death of livestock	0.025	–0.002	–0.042*	–0.001
	(0.025)	(0.026)	(0.025)	(0.059)
theft	0.018	–0.008	0.083*	0.014
	(0.031)	(0.028)	(0.032)	(0.078)
loss of paid employment	–0.059*	0.082**	–0.023	–0.112
	(0.031)	(0.026)	(0.038)	(0.117)
forced eviction	0.014	–0.053	–0.059	–0.006
	(0.050)	(0.050)	(0.046)	(0.148)
social group	0.027	0.029	–0.016	–0.022
	(0.051)	(0.062)	(0.046)	(0.126)
microfinance	–0.053**	0.017	–0.167**	0.263*
	(0.055)	(0.048)	(0.051)	(0.131)
drought	–0.109	0.038	–0.107**	0.158*
	(0.028)	(0.032)	(0.030)	(0.080)
flood	0.022	0.001	–0.037	0.009
	(0.026)	(0.027)	(0.027)	(0.076)
health centre	–0.018	0.053	–0.224**	–0.083
	(0.030)	(0.035)	(0.033)	(0.106)

reflect a preference of mothers to have their biological children working with them in the home, while the father effect suggests that fathers put more weight on the welfare of biological children than on the welfare of step-children. Children of older mothers tend to spend less time in school and children of older fathers tend to spend less time in play, while children of households with a male head spend les time in both of these acitivies and more time in income-generating work, so it appears that younger parents and mothers attach mores weight to the welfare of their children than older parents and fathers. Droughts lead to a reallocation of children's time from domestic work to income-generating work, as does the presence of a microfinance facility, which raises concerns about the possible unintended consequences of such facilities. Finally, the presence of a health centre reduces the amount of time spent in domestic work, suggesting that access to healthcare services does mitigate the effect of maternal illness.[8]

A3. Determinants of Household Expenditure

In Table A3 we report coefficients from a fixed-effects model of (i) the logarithm of total household food expenditure and (ii) the logarithm of total household non-food expenditure. The explanatory variables are the same as in Table A2, except that the child-specific variables are omitted. Table A3 shows that *ceteris paribus*, wealthier households, larger households, urban households and households with access to a health facility have significantly higher levels of both types of expenditure. Theft necessitates higher expenditure on non-food items, the illness of a household member other than the mother or father necessitates higher expenditure on food, and forced eviction necessitates higher expenditure of both types. Access to a microfinance facility is associated with lower food expenditure, which again raises some concerns about the unintended

[8] One further significant effect is that adult unemployment leads to a reallocation of children's time from play to schooling. The cause of this puzzling effect is a subject for future research.

Table A3. Estimated effects on household expenditure

	food expenditure	*non-food expenditure*		*food expenditure*	*non-food expenditure*
mother ill	–0.025	0.025	*urban*	0.169*	0.418**
	(0.023)	(0.038)		(0.076)	(0.118)
father ill	–0.049	–0.154**	*illness of*	0.051*	0.040
	(0.030)	(0.044)	*another person*	(0.026)	(0.040)
mother's	–0.023	–0.010	*crop failure*	–0.009	–0.088*
education	(0.019)	(0.025)		(0.026)	(0.040)
mother's age	–0.003	–0.002	*death of*	–0.025	0.010
	(0.004)	(0.006)	*livestock*	(0.028)	(0.038)
father's	0.017	–0.016	*theft*	0.033	0.143**
education	(0.019)	(0.027)		(0.034)	(0.055)
father's age	0.005*	–0.003	*loss of paid*	–0.041	–0.014
	(0.003)	(0.004)	*employment*	(0.036)	(0.046)
mother's	0.225	–0.153	*forced*	0.079*	0.156*
power	(0.245)	(0.458)	*eviction*	(0.046)	(0.072)
male head	0.005	0.021	*social group*	0.035	0.049
	(0.055)	(0.077)		(0.048)	(0.055)
household size	0.047**	0.069**	*microfinance*	–0.095*	0.038
	(0.010)	(0.015)		(0.047)	(0.061)
wealth index	0.367**	1.360**	*drought*	–0.082**	–0.098*
	(0.144)	(0.214)		(0.027)	(0.039)
owns animal	0.062*	0.011	*flood*	–0.040	0.075*
	(0.033)	(0.063)		(0.024)	(0.041)
land size	0.001	–0.006**	*health centre*	0.050**	0.102*
	(0.001)	(0.001)		(0.030)	(0.044)
observations	*4,538*	*4,538*		*4,538*	*4,538*

consequences of such facilities. Conditional on these effects, the paternal illness is associated with a 15% reduction in non-food expenditure, but none of the other parental illness effects is significantly different from zero. Our interpretation of the asymmetry in the expenditure effects of maternal and paternal illness is discussed in section 4 of the main text.

Appendix Reference

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