# Health Shocks and Child Time Allocation Decisions of Households: *Evidence from Ethiopia*

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# Acronyms

| | |
|---|---|
| APEs | Average Partial Effects |
| CSA | Central Statistical Agency |
| CRE | Correlated Random Effects |
| DALYs | Disability Adjusted Life Years |
| FEP | Fixed Effects Poisson |
| FOCs | First Order Conditions |
| GDP | Gross Domestic Product |
| HIV | Human Immunodeficiency Virus |
| ILO | International Labour Organization |
| IMF | International Monetary Fund |
| MDGs | Millennium Development Goals |
| FMOH | Federal Ministry of Health |
| NAR | Net Attendance Ratio |
| SNNPR | Southern Nations Nationalities and Peoples Region |
| UN | The United Nations |
| UNDP | United Nations Development Program |
| UNSNA | United Nations System of National Accounts |
| WHO | World Health Organization |
| YLD | Years Lost due to Disability |
| YLL | Years of Life Lost |

# Abstract

There is growing evidence that health shocks can entail catastrophic out-of-pocket medical spending, functional disability and the loss of income. However, little is known whether or not such economic consequences affect allocation of children's time between alternative activities. We assess how households behave with respect to the allocation of children's time between work, leisure and school in the face of parental illness. Using longitudinal data from Young Lives survey for 2006 and 2009 and applying fixed effects estimation techniques, we find that parental illness significantly affects allocation of children's time. The effects seem to be consistent with the traditional female-male roles at household level. Paternal illness increases time spent in market work, whereas maternal illness increases time spent in domestic work. We also make a distinction between child work and child labour, an activity which violates international labour standards. We find that change in parental health status strongly affects child labour. Interestingly, the effect has gender dimension. While illness of the mother has stronger effect on girls than boys, illness of the father has stronger effect on boys than girls.



Key Words: parental illness; coping strategy; time allocation; child labour; Ethiopia

# 1. Introduction

Health shocks are among the most unpredictable and costly sources of economic hardship in developing countries. When a family member is ill, households may be subject to catastrophic out-of- pocket payments for treatment. Disabling conditions from chronic illness can also entail loss of labour supply and income .There is growing evidence that households slip into poverty and experience welfare loss due to financial risks of chronic illness (McIntyre, Thiede, Dahlgren, & Whitehead, 2006; Mendola, Bredenkamp, & Gragnolati, 2007; Sparrow et al., 2014; Wagstaff, 2007).

Unless insured, parental illness can have huge effect on allocation of children's time. First, if households face large income loss to illness and treatment costs absorb a substantial share of their budget, households may decide to send their children to work to supplement family income. Second, irrespective of its expenditure and income effects, illness may still affect allocation of children's time. Children may be required to provide supportive care to the ill parent and perform household chore so that healthy adults would be able to participate in the labour market. Furthermore, even if they are not required to work, children may be unable to attend school since out-of-pocket payments may undermine households' ability to invest in children's' education.

From a policy perspective, participation in child work may have detrimental effect on children's welfare. For example, children may be required to work under hazardous conditions which may harm their health and mental and physical development. In addition to causing physical and mental fatigue, work can also interfere with children's education. For instance, children working several hours a day may have little or no time to go to school (Haile & Haile, 2012; Rosati & Rossi, 2001; Rosenzweig & Evenson, 1977; Udry, 2006). Indeed, even though they may be able to attend school, working children are more likely to repeat grades. This is because they could be emotionally exhausted to fully benefit from instructions received in school (Duryea, Lam, & Levison, 2007; Heady, 2003).

Notwithstanding the policy importance of a good understanding of the effects of parental illness on allocation of children's time, the existing empirical evidence is scanty. To the best of our knowledge, only Dillon (2012) has estimated child labour and schooling responses to

illness. Despite the attempt to contribute to the very scant literature, the study has some data and methodological limitations.

First, while there is a clear distinction between child work and child labour, Dillon (2012) treats child labour as mere participation in child work. Child labour refers to activities that interfere with children's education, deprive their childhood and harm their mental and physical development (ILO, 1973; UN, 1989). This implies that not all form of child work is harmful to children. Indeed, depending on their age and the type of task they perform, children may benefit from participation in light work. While working, children may even acquire skills useful for their future life or earn income that can be used to meet their educational and health needs (Cigno & Rosati, 2002; Moehling, 2005). Even from human rights perspective, participation in some work activities is permissible as far as the tasks are harmless to child welfare (ILO, 1973). Therefore, misclassification of children's child labour status, by causing measurement error, can confound consistency of estimates (Hausman, Abrevaya, & Scott-Morton, 1998; Lewbel, 2000).

Second, the study uses a cross-sectional approach in identifying the effects on time allocation of illness. The approach overlooks, however, heterogeneity problems that may arise from unobserved child fixed effects. For example, parents heavily discounting investment in human capital may under invest in their own health, hence experience poor-health and under invest in their children's education, hence allocate shift time from school to work. Thus as long as unobserved heterogeneity is left unaccounted for, the estimation results show nothing but correlation.

In this paper, we assess how households behave with respect to the allocation of children's time between alternative activities in the face of parental illness. To better understand welfare implications time allocation effects of parental illness, we also make a distinction between child work and child labour, an activity which violates international labour standards. We adopt a statistical definition of child labour developed by United Nations Children's Emergency Fund (UNICEF).[1] Cconsistent with the guidelines set by International Labour Organization's Minimum Age Convention (ILO, 1973) and the resolutions of the '18$^{th}$ International Conference of Labour Statisticians' (ILO, 2008), the definition takes work

[1] The definition is discussed in section 4

intensity and child age differences into account.[2] We further examine the gender dimensions of the effect of parental illness on child labour; whether illness of the father and the mother are equally important for boys' and girls' child labour participation.

We use longitudinal data from Young Lives survey for 2006 and 2009. Young Lives is a research project on child poverty in Ethiopia, India, Peru and Vietnam conducted by a team based at the University of Oxford in collaboration with governmental and non-governmental organizations in the partner countries. Our study is restricted to the survey in Ethiopia. We use time diary data from two groups of children: the young cohort and the old cohort. The former consists of 1299 children aged 5 to 6 years and the latter comprises of 970 children aged 11 to 12 years in 2006. To account for unobserved heterogeneity, we apply fixed effects estimation techniques while estimating effects on time allocation of illness of the mother.

Our findings show that allocation of children's time between work and leisure significantly responds to parental illness. Children work more hours and spend fewer hours in leisure when their parents are ill. Disaggregating data into different work and leisure activities reveals a heterogeneous picture of the relationship between illness and time allocation. While illness of the father reduces time spent in school and increases time spent in market work, illness of the mother reduces time spent in play and increases time spent in domestic work. However, children spend fewer hours in market work when the mother is ill. Disaggregating data by gender shows that illness of the mother has stronger effect on girls, whereas illness of the father has stronger effect on boys. Indeed, we find no significant effect of illness of the father on time use by girls. Overall, time allocation effect of parental illness seems to be consistent with the traditional male-female roles.

We find also child labour increases with parental illness. Estimations obtained with the full-sample show that illness of the mother is associated with increase in her child's probability of child labour participation by 9.6 percentage points. However, illness of the father is found to have no effect on child labour. Disaggregating the sample into boys and girls, however, shows that child labour effect of parental illness has gender dimension. With no child labour effect on girls, illness of the father is associated with 7.2 percentage point increase in the

[2] To resolve the ongoing confusion in defining child labour, in 2008, the 18th International Conference of Labour Statisticians set a standard for statistical definition of child labour. The resolution sets two important guidelines to address the problem. First, it identifies children aged 5 to 17 to be the target population for child labour data collection. Second it suggests child labour definition to constitute also hazardous unpaid household services.

probability of child labour participation of boys. On the contrary, illness of the mother has stronger child labour effect on girls. When the mother is ill, girls are 6 percentage points more likely than boys to be involved in child labour.

The remainder of the paper proceeds as follows: section 2 gives a brief review of the literature; section 3 provides background information about Ethiopia; section 4 describes and summarises the data; section 5 discusses the theoretical framework and empirical models; section 6 provides discussion of the estimation results and section 7 concludes with the main findings and draws on some implications.

# 2. Background Literature

## 2.1 Economic Vulnerability and Allocation of Children's Time

In a standard work-leisure model, an individual's labour supply decision is treated as part of her utility maximisation objectives. Optimal number of hours spent in work and leisure is mainly determined by the amount of resources available to maximise utility. Adjustment between time spent in work and leisure is made until marginal utilities from work and leisure become equal. Given other things, an increase in non-labour income is expected to increase time spent in leisure (Becker, 1965).

Decision regarding allocation of children's time is generally believed to be made in a similar manner. Parents are aware of the fact that while providing immediate benefits to the family in the form of income or labour contribution, time spent in work entails forgone utility from leisure time. The assumption is parents behave altruistically towards their children and they do everything possible to minimise welfare consequences of work on their children. Despite they are aware that work may interfere with children's education and has welfare costs in the form of forgone leisure time, actual time allocation decision is made from the perspective of maximising the utility of the whole family. When parents earn enough income to meet basic needs of the family, they value the welfare costs of child work more than its benefits and allocate less time to child work. On the contrary, when their income falls short of the amount required to meet the family's need, they would allocate more time to child work (Basu & Van, 1998).

This implies that poverty and associated shocks that push households into poverty can highly influence time allocation decision outcomes. Poverty undermines household's ability to forgo income from child work and invest in their children's education. Despite poor parents are aware of the fact that time spent in school can bring about high returns in the future, they may shift time away from school to work so as to supplement family income. Parents facing resource constraints highly discount future returns from education and send their children to work. The incentive for shifting child time from school to work increases when earning opportunities elsewhere are inadequate to meet basic needs of the family (Baland & Robinson, 2000; Ranjan, 1999). Fallon and Tzannatos (1998) and Udry (2006) argue that

child labour, which is a form of child work believed to interfere with children's education and undermines their welfare (ILO, 1973), is a result of chronic poverty.

Related to poverty are effects of vulnerability to shocks. Households, especially those in the neighbourhood of the poverty line, may slip into poverty as a result of catastrophic shocks (Morduch, 1994).[3] For example, in communities where agriculture is the main source of livelihood, death of livestock or crop failures may heavily reduce household income (Beegle, Dehejia, & Gatti, 2006). Similarly, unemployment and illness or death of the main breadwinner in the family may cause huge financial strain (Duryea et al., 2007; Gertler & Gruber, 2002). Therefore, households may resort to child labour and allocate less time to leisure or education unless other coping strategies are available at the required scale.

Analysis of the time allocation effects of poverty and shocks hinges on two important assumptions: parental altruism and diminishing marginal utility of income. In their 'Luxury Axiom', Basu and Van (1998) state that parents behave altruistically towards their children and consider child labour bad to their children. Thus they allocate time for child labour only if adult income is insufficient to fulfil basic needs of the family, implying that that leisure is a luxury good. In a similar vein, the contribution of child income to family income is assumed to give higher utility when the family earns less income than the subsistence threshold. Accordingly, the value of one extra dollar to the family income from child labour is expected to fall as the family becomes wealthier (Edmonds & Pavcnik 2005).

The implication is that poverty and income loss may not always be the reasons for allocation of more time to work and less time to education if parents are not purely altruistic. In the presence of parental callousness, parents would value return from time spent in work more than returns from time spent in leisure activities or education. Therefore, children may be required to work irrespective of the level of household income. In their study of time allocation decision of American parents in the late nineteenth century, Parsons and Goldin (1989) argue that parents selfishly acted to maximise their benefit and sacrificed their children's future earnings from education. The authors note that child income was equally tread with adult income and children were working while parents were accumulating savings.

[3]Indeed, poverty and income shocks seem to coexist and causality runs in both directions. Poverty can increase vulnerability to income shocks. Poor households often live in environments which are highly susceptible to calamities of nature such as drought, flood and earthquake (Morduch, 1995).

They conclude that decisions to send children to work were made neither due to poverty nor income constraints but due selfish behaviour of parents to exploit market opportunities.

Nevertheless, analysing the same data that Parsons and Goldin (1989) used, Bhaskar and Gupta (2012) refute the claim that parental callousness was responsible for high incidence of child labour. They argue that time allocation decisions made by American parents at the end of the century were highly influenced by resource constraints not by exploitative behaviours of parents. The authors assert that parents were altruistic but they were unable to meet basic needs without sending their children to work.

Indeed, a large body of empirical literature also seem to support the poverty hypothesis. In their cross-country study, Edmonds and Pavcnik (2005) find that variation in real Gross Domestic Product (GDP) per capita explains about 73 percent of the variation in rates of child labour participation. Survey reports from 84 countries show that child labour is more pervasive in low income than in high income countries. Country case studies also show that child labour coexists with poverty. For example, in Bolivia, the rate of child labour participation among households in the lowest quintile is four times higher than the rate in the highest quintile. The difference is even worse in Congo and Sudan, with factors of five and eight, respectively (ILO, 2013b). Jensen and Nielsen (1997) also note that high incidence of child labour in Zambia mainly arises from widespread poverty. Edmonds (2005) shows that, in 1993, the rate of child labour participation in Vietnam was 30 percentage points higher among households below poverty line.

On the other hand, a finding by Bhalotra and Heady (2003) in Pakistan seems to raise some doubt on the poverty hypothesis. The authors find higher incidence of child labour among land rich households than land poor households. Given that land is an important source of wealth in most rural economies, their finding suggests some form of 'wealth paradox'. For Basu, Das, and Dutta (2010) a positive relationships between farm size and child labour is attributed to market failures and does not reflect 'wealth paradox'. They argue that child labour initially increases because land ownership creates job opportunity for previously unemployed children in land poor households. However, the wealth effect from land ownership will eventually dominate substitution effects as land size increases and child labour will decreases. Their empirical investigation using data from India shows that child labour decreases after farm size reaches 4 acres.

Studies that examine the relationship between child labour and household income seem to strengthen the claim that poverty is responsible for high incidence of child labour. Edmonds (2005) tracks nearly 3000 Vietnamese households between 1993 and 1998 and finds that a 50 percent increase in real per capita expenditure of households was associated with a substantial decrease in child labour. A number of studies evaluating impacts of cash transfer programs in countries such as South Africa (Edmonds 2006), Ecuador (Edmonds & Schady, 2009), Mexico (Skoufias, Parker, Behrman, & Pessino, 2001) and Brazil (Bourguignon, Ferreira, & Leite, 2003) also show that cash handouts to poor households have bolstered child welfare through increased school attendance and reduced child labour.

Exposure to shocks is also found to have significant effect on allocation of children's time. For example, Beegle et al. (2006) find in Tanzania that crop failure induces high incidence of child labour. Using data from 15 rural villages in Ethiopia, Colmer (2013) finds a similar result. He notes that number of hours spent on household farm increases by 17.16 percentage points for one standard deviation change in climate variability. Interestingly, the number of hours spent in household chores falls by 12.88 percentage points for a similar change in climate variability. This suggests that time adjustment between farm and domestic activities may help parents keep their children in school.

Similarly, Guarcello, Kovrova, and Rosati (2008) find in Cambodia that children who live in villages hit by crop failure are 43 percent more likely than children in shock free villages to be involved in work activities. However, their finding shows that shocks have little effect on school attendance. This implies that children might have managed to reconcile work and school. By modelling human capital investment decision under uncertainty, Jacoby and Skoufias (1997) examine how risks in agrarian communities affect children's education. Their empirical findings show that, in rural villages of India, occurrence of shocks is associated with school attendance irregularities. This implies that some resources, either child time or money, might have been shifted away from education to buffer households against shocks.

Household level shocks are also found to have impact on child labour and schooling. Using data from Guatemala, Guarcello, Mealli, and Rosati (2010) assess the impact of shocks such as crime, unemployment, death and migration of a household member on child work and

school attendance.[4] They find that children's probability of participation in child work is five percentage points higher among children's of households experiencing at least one of the shocks. Considering only children enrolled in school, the probability of working fulltime is 1.5 percentage points higher; implying that shocks can lead to school dropout.

Duryea et al. (2007) using data from Brazil consider a sample of close to 100,000 children aged 10-16 years to examine the effect of unemployment of the household head on child work and schooling. The study reveals that unemployment of the household head for 4 consecutive months significantly increases the probability of child labour participation, school dropout and failure to progress to the next grade. For example, compared to children in families with employed father, children of unemployed father are 18 percent and 9 percent, respectively more likely to be out of school and repeat grades. Nevertheless, Skoufias and Parker (2006) find no evidence of effect of unemployment on child labour and education in Mexico. Disaggregating the sample into boys and girls they find, however, that girls are 7.5 to 8.5 percent more likely to miss class when the family experiences unemployment of the father. The authors still find no effect of unemployment on girls' participation in the labour force and their progress to the next grade.

In sum, poverty and income shocks are important factors determining allocation of children's time. Despite providing immediate benefit to households in terms of filling resource gaps, child work can interfere with other competing uses of time such as leisure and schooling. Thus, while making time allocation decision, altruistic parents weigh the costs and benefits of child work. The weights they attach to returns from work and leisure, however, may depend on the household's budget and consumption needs. When budget falls short of consumption needs, parents would heavily discount forgone benefits from education or leisure and allocate more time to work. Empirical evidence shows that incidence of child labour is higher among poor than non-poor households. Exposure to shocks that entail large income loss is also found to increase work hours and reduce school attendance.

[4]The authors consider households as being hit by a shock if they experience at least one of the shocks listed. Such aggregation, however, may confound the estimation results as different shocks may have different effects. In addition, given similar household characteristics, households facing two or more shocks may behave differently from those experiencing only one shock.

## 2.2 Economic Consequences of Ill health

The economics of health has increased in popularity since the seminal work of Grossman (1972).[5] While treating health as an investment good, Grossman argues that health is different from other forms of human capital such as a stock of knowledge. According to Grossman, knowledge determines a person's productivity, whereas health determines the amount of time she can spend on producing money earnings and goods that enter her utility. He further notes that investment in health capital, in addition to reducing disutility from morbidity, increases the number of healthy days in a given period that a person can use for market and home production.

Health is also considered in life-cycle models one of the key factors shaping households' saving and consumption behaviours. Few studies note that uncertainty about future health conditions and associated financial risks explain much of households' saving motives (Bloom, Canning, & Graham, 2003; Hubbard, Skinner, & Zeldes, 1994; Palumbo, 1999). Thus failure to incorporate such uncertainties in saving and consumption models may over predict current consumption expenditures. Similarly, Dynan, Skinner, and Zeldes (2002) suggest that households often save due to bequest and precautionary motives. According to the authors, if bequest motives disappear because of some confiscatory estate, total saving will fall only slightly as long as households expect health risks in the future.

Accordingly, deterioration in health condition can have huge economic consequence on households. Chronic illness can entail catastrophic out-of-pocket payments for medical care and loss of working days or productivity, which ultimately lead to loss of income (Mendola et al., 2007; Smith, 2005; Wagstaff, 2007). Empirical evidence shows that illness of working age household members lowers earned income by imposing functional disability and limiting employment opportunities. Using data from the United States, Smith (2005) finds that a person experiencing deterioration of health status works on average 4 hours less per week than she would work under normal condition and she is 15 percent less likely to remain in the labour force.

[5]Previously, health had been considered one form of human capital to have similar effect on production of goods and services to that of education. Accordingly, individuals were assumed to behave similarly while making investment decisions for health and education (Mushkin, 1962).

Using data from Germany's socioeconomic survey, Riphahn (1999) finds that illness of a working age individual reduces the probability of being fully employed by 6 percent, increases the probability of working part-time, unemployed and leaving the labour force by 60 percent, 84 percent and 200 percent, respectively. Similarly, a study in the Netherlands finds that illness reduces the probability of employment by 6.7 percent and 7 percent, respectively among people aged 18-49 and 50-64 (García-Gómez, Van Kippersluis, O'Donnell, & Van Doorslaer, 2013). Evidence from Spain shows that people experiencing heath shocks are 5 percent less likely to be employed (García Gómez & López Nicolás, 2006).

If ill health has such a disastrous employment effect in developed countries, where well-functioning healthcare and social security services are available, we would expect the effect in developing countries, where such services are missing or poorly functioning, to be even worse. Studies conducted in different countries reveal that illness remains one of the most unpredictable and costly sources of economic hardships. Using data from Indonesia, Gertler and Gruber (2002) find that a change in health status of the household head from completely healthy to unhealthy condition leads to 84 percent fall in the baseline weekly work hours.

Studies in Africa also show similar results. For instance, Cropper, Haile, Lampietti, Poulos, and Whittington (2000) estimate a single incidence of malaria infection in Northern Ethiopia to result in a loss of up to 26 working days. In addition, even though people may not change their work habit as a result of illness and still work the same amount of time as they used to work when they were healthy, they may experience a decline in productivity. In this regard, Schultz and Tansel (1997) find in Côte d'Ivoire and Ghana, respectively that productivity of a worker suffering from poor health falls by 10.5 percent and 11.7 percent.

Given other things, an a person earns less income if she works fewer hours or becomes less productive due to poor health conditions. Empirical evidence shows that illness of a working age person is associated with falling earned income. Using data from Vietnam, Wagstaff (2007) finds a strong negative effect of illness of a working-age household member on earned income of households. Schultz and Tansel (1997) estimate that income loss to a disabled working day to be 26 percent and 33 percent, respectively in Ghana and Côte d'Ivoire.

Chronic illness is found to have catastrophic income effects even in developed countries. Abegunde and Stanciole (2008) find in Russia that labour income of households experiencing chronic illness falls at a rate of 4.8 percent. In some cases, household income may fall even by an amount more than the amount that the ill household member lost. This is because healthy household members may have to withdraw from labour market to provide caring service for the patient; implying possible spill-over effects. Evidence from the Netherlands, for example, shows that illness of the household head increase probability of unemployment of the spouse. As a result, while income of the ill person falls by 5 percent, total household earned income falls by 7.5 percent (García-Gómez et al., 2013).

Another most important channel through which illness affects economic conditions of households is treatment cost. When faced with chronic illness, households may have to spend a substantial share of their income on medical care. Evidence from Russia shows that health shocks are associated with 6.2 percentage points increase in medical expenditure (Abegunde & Stanciole, 2008). In countries where there is little or no access to formal insurance against illness,[6] households may have to bear the brunt of catastrophic treatment costs through out-of-pocket payments. A study using data from Albania shows that 60 percent of health care expenses are financed through out-of-pocket payments. It reveals also that out-of-pocket health care payments increase headcount poverty and poverty gap by 27 percent and 36 percent, respectively (Mendola et al., 2007).

Using data from Indonesia, Sparrow et al. (2014) find that out-of-pocket-payments for medical care double following illness episodes. Even in the presence of access to insurance, illness may result in high cost of curative care as insurance policies may not fully cover treatment costs. For example, Wagstaff, Lindelow, Jun, Ling, and Juncheng (2009) find in rural China that, despite households being covered by health insurance programs, illness leaves them with large amount of out-of-pocket payments.

[6]Indeed, evidence shows that, even in countries with well-developed insurance system out-of-pocket payments remain an important source of financial burden to elderly people (Palumbo, 1999).

## 2.3 Coping with Illness: Alternative Strategies

When faced with chronic illness, households may use a range of coping strategies including child labour to smooth income and consumption. Understanding welfare consequences of child labour, however, altruistic parents would consider using other strategies before turning to child labour.

In the existence of perfectly functioning financial markets, households may be able to borrow at a competitive interest rate and smooth consumption without the need to resort to child labour (Baland & Robinson, 2000; Ranjan, 1999). Using distance to financial institutions as a proxy for access to formal financial markets, Gertler, Levine, and Moretti (2009) assess the role of financial markets in protecting households against welfare risks of illness in Indonesia. They find that health shocks have smaller effect on consumption of households residing 1 kilometre away than those households living 10 kilometres away from commercial banks and microfinance institutions.

Households may also have a wealth of informal coping strategies to smooth consumption without the need to shift to child labour. Helping one another could be an important strategy to cope with shocks in communities where there is little access to formal social security schemes. Households unaffected by illness may extend their help, giving cash or in-kind, to households losing income to illness expecting reciprocity at a future date as the same fate might befall them (De Weerdt & Dercon, 2006). Thus households may seek assistance from friends, neighbours or extended families. They may also draw on their savings, sell assets or approach a local money lender (Alderman & Paxson, 1992).

Empirical evidence in shows that households a range of informal coping strategies when experiencing with illness. A study on coping strategies used in 15 African countries including Ethiopia shows that majority of households experiencing illness sell their assets and borrow money to pay for medical treatments (Leive & Xu, 2008). Additional evidence shows that the use of informal coping strategies is not limited only to Africa. For example, examining data from 40 low and middle income countries around the world, Kruk et al. (2009) note that borrowing and sale of assets are the most common strategies households use to pay for medical treatment. Sparrow et al. (2014) also find in Indonesia that households heavily rely on sale of assets and borrowing to deal with financial consequences of illness. Similarly,

Mohanan (2013) finds in India that more than 70 percent of households facing chronic illness borrow money to pay for medical expenditures.

The problem is alternative coping strategies may not be always available at the required scale. For instance, in developing countries, financial markets are either missing or imperfectly functioning (Banerjee & Duflo, 2007). Informal coping strategies also may not provide full insurance, especially for poor households. Dissaving and sale of assets can be options only for households which hold enough stocks as surplus over current consumption. However, households with poor health are mostly those with poor living conditions. Because the poor have limited access to health service and suffer from malnutrition that translates into ill health (Hamoudi & Sachs, 1999). Therefore, they are less likely to have enough savings or asset holdings to buffer against health shocks (ILO, 2013b). Even when they have surplus production to save, storage could be a problem. For example, in agricultural communities, produces are in the form of crops or livestock, which may be difficult to store for future use. In some cases, even opportunities for leasing or selling assets such as land could be highly limited due to market imperfections or policy restrictions.

Borrowing also may not be a reliable means to smooth consumption. With high degree of uncertainty about returns from investment in health, lending institutions may require households to meet large collateral requirements (Wagstaff, 2007). On the other hand, health shocks can directly diminish assets which can be used as collaterals as the ill household member may have to consume them to maintain welfare (Beegle et al., 2006). Illness can also undermine the value of human capital that 'well-informed' lenders use to select potential borrowers (Gertler et al., 2009). This implies that illness of main breadwinners can badly damage credit worthiness of households and loan applications can be easily turned down.

Even if households are able to borrow from informal lenders, they may face high level of debt accumulation due to high interest rate (Kruk et al., 2009). Cost of debt financing would be even high when the main breadwinner is ill. Mohanan (2013) in India and Wagstaff et al. (2009) in China find that borrowing for medical treatment has subject households to huge debt accumulation. The finding by Mohanan (2013) also shows that households cut spending on children's education in the face of health shocks. This implies that, households may have cut spending on education to service debt. Although the study does not provide further evidence, lower spending on education may also mean lower rate of school attendance.

A relatively safer strategy to cope with health shocks may be to use labour supply adjustment. Consistent with the 'added-worker effect' hypothesis, healthy members of the household may increase labour supply to compensate for lost income of the ill household member. There is already growing evidence showing that households use intra-household labour supply adjustment to cope with financial risks of illness. While some studies are restricted to spousal labour supply response to illness of the household head (Coile, 2004; Garcia-Gomez, van Kippersluis, & van Doorslaer, 2011), others examine the response in labour supply of healthy household members to illness of a working age family members (Gertler & Gruber, 2002; Sauerborn, Adams, & Hien, 1996; Wagstaff, 2007).

Using data from Burkina Faso, Sauerborn, Adams, and Hien (1996) find that intra-household labour supply adjustment is used as a key strategy to address labour supply shortages due to illness. Both Sparrow et al. (2014) and Gertler and Gruber (2002) find in Indonesia that other members of the household work more hours when the household head experiences poor health. Wagstaff (2007) also finds that labour supply adjustment is an important strategy in Vietnam, especially in rural parts of the country, to cope with health shocks. The finding by Sparrow et al. (2014), however, shows that labour supply adjustment is more important in urban than in rural areas.

## 2.4 Coping with Illness: Allocation of Children's Time

As discussed in section 2.1, a large body of literature suggests that shocks that entail large loss of income can have significant effect on allocation of children's time. Another strand of literature discussed in section 2.2 suggests that poor health can result in catastrophic out-of-pocket payments and cause loss of productive days and income. If households worry about smoothing income and consumption because earning opportunities elsewhere are limited, they may resort to child labour. The fact that households use labour supply adjustment as a coping strategy also suggests that illness might have indeed affected allocation of children's time.

Effects on allocation of children's time of illness seem to be more obvious than effects caused by other shocks such as unemployment, crop failure or drought. Shocks such as unemployment and crop failures, for example, mainly affect time allocation only through

their effect on income, whereas illness can affect allocation of children's time through three different ways. First, loss of income to disabling conditions of illness can result in loss of income and children may be required to work to supplement family income. Second, ill household members may seek treatment. In the absence of insurance coverage, treatment costs may absorb a substantial share of the household budget (McClellan, 1998; McIntyre, Thiede, Dahlgren, & Whitehead, 2006). Thus households may need to either send their children to work or take them out of school as a strategy to cope with financial strains. Third, irrespective of its expenditure and income effects, illness may still affect allocation of children's time. Children may be required to provide supportive care to the ill household member. They may also perform household chore so that healthy adults would be able to participate in the labour market.

Indeed, decision to use child labour as a coping strategy may depend on whether or not children have the required skill and physical strength to take on responsibilities of the adult suffering from illness. Children would be required to take on responsibilities of adults, such as the mother and the father only if substitution between child and adult labour is possible. In this regard, theoretical literature treats adult and child labour as substitutes (Basu et al., 2010; Basu & Van, 1998; Ranjan, 1999). A report by ILO seems also to confirm the theoretical presumption. It states that "child labour is a cause of, and may even contribute to, adult unemployment and low wage rates" (ILO, 1988, p. 90). This does not necessarily mean, however, that child and adult labour are perfect substitutes.

Degree of substitution may depend on the nature of tasks and production technologies used at work. For example, some tasks may require physical strength and stamina, whereas others may require certain level of skill that children may lack. In addition, certain labour market conditions, usually employment in the formal sector, may not allow substitution of the child for her ill parents. On the other hand, children may easily be able to takeover responsibilities of their parents in doing household production. In this regard, studies that find negative relationship between adult wage and school attendance conclude that adults and children are substitutes only in domestic activities (Goldin, 1979; Skoufias, 1993).

Child labour and adult labour can be also complements. For example, children's involvement in certain tasks may require supervision by adults. Thus a child may have to be accompanied by an adult while working. Empirical evidence also shows existence of some degree of

complementarity between child labour and adult labour. Using data from Egypt, Diamond and Fayed (1998) find that while adult men and children are complementary, adult women and children are substitutes in the labour market. On the other hand, using data from Pakistan, Ray (2000) finds women and girls are complements in market work. On the contrary, his finds in Peru that that adult men and girls are substitutes. Complementarity between child and adult labour implies that absence of adults from work due to illness may set children free to school or enjoy leisure time.

Effects on allocation of children's time of illness could be also gender specific. In some traditions, women and men may have distinct roles to play in the family. For example, while the women may be responsible for household production, men may be responsible for market production and work outside the house such as working on farms (Basu et al., 2010; Gibbons, Huebler, & Loaiza, 2005).[7] Gender specific roles could also apply to children. If so, illness of the mother and the father may have different effects on children's time allocation. Time allocation effect of maternal illness may be stronger for girls than for boys. On the other hand, illness of the father may have stronger time allocation effect for boys than for girls.

Despite growing evidence that households use labour supply adjustment to cope with ill-health, little is known whether or not children are part of labour adjustment strategies. Accordingly, there is scant evidence on how allocation of children's time responds to illness, especially parental illness. One study attempts to examine the relation between child work illnesses. Using cross-sectional data from Northern Mali, Dillon (2012) estimates how allocation of children's time between competing uses respond to illness of adult members of the household. His finding shows that illness of an adult male is associated with 2.9 hours increase in time for school and 2.6 hours increase in time for working in household enterprises. On the other hand, illness of an adult female is associated with 1.6 hour increase in time spent on caring for younger siblings.

First, while there is a clear distinction between child work and child labour, Dillon (2012) treats child labour as mere participation in child work. Child labour refers to activities that interfere with children's education, deprive their childhood and harm their mental and physical development (ILO, 1973; UN, 1989). This implies that not all form of child work is

[7]Such a traditional household setting is also very common in Ethiopia (Haile & Haile, 2012).

harmful to children. Indeed, depending on their age and the type of task they perform, children may benefit from participation in light work. While working, children may even acquire skills useful for their future life or earn income that can be used to meet their educational and health needs (Cigno & Rosati, 2002; Moehling, 2005). Even from human rights perspective, participation in some work activities is permissible as far as the tasks are harmless to child welfare (ILO, 1973). Therefore, misclassification of children's child labour status, by causing measurement error, can confound consistency of estimates (Hausman et al., 1998; Lewbel, 2000).

Second, the study uses a cross-sectional approach in identifying the effects on time allocation of illness. The approach overlooks, however, heterogeneity problems that may arise from unobserved child fixed effects. For example, parents heavily discounting investment in human capital may under invest in their own health, hence experience poor-health and under invest in their children's education, hence allocate shift time from school to work. Therefore, unless the estimation procedure accounts for unobserved heterogeneities, the results would show only correlation.

Third, besides the methodological and data issues, Dillon (2012) estimates time allocation effects of illness of working age members of households, grouping them as adult male and female. However, the household head and the spouse may play much more role than other household members in terms of contribution to the household income. They may also have more power than others in making intra-household allocations. Accordingly, changes in their health status may be much more important than changes in the health status of other household members for decision for allocation of children's time. Thus inclusion of measures of illness of the father and the mother in time allocation models as may tell a different story about time allocation effects of illness.

# 3. Country Background

Ethiopia is located in East Africa. Despite its ancient civilization and long history of independence, Ethiopia remains one of the poorest countries in the world. In the last two decades, however, the country has been enjoying a rapid economic growth and an impressive poverty reduction (Seyoum, 2013). For example, from 2003/04 to 2013/14 Ethiopia registered an average of 10.8 percent GDP growth rate compared to the regional average of only 4.8 percent in Sub-Saharan Africa (World Bank, 2015b). National poverty rate also dropped from 38.7 percent in 2004/05 to 26 percent in 2012/13. Ethiopia has also been one of the few countries in the world that have made a tremendous improvement in Human Development Indicators. Over the period 2004 to 2012, while illiteracy rate dropped from 71 percent to 53.3 percent, basic health service coverage rose from 76.9 to 94 percent (UNDP, 2014). In terms of achieving the Millennium Development Goals (MDGs), the country has made a remarkable progress in reducing child mortality and increasing access to primary education, clean water and sanitation (IMF, 2015)

Nevertheless, gains in terms of social welfare improvement remain to be among the lowest in the world due to country's low starting base. Specific to children, Ethiopia has one of the lowest school enrolment rates and highest rates of child labour participation even in Sub-Saharan African Standards (ILO, 2013a).

## 3.1 School Attendance

Figure 1**Error! Reference source not found.** presents School Net Attendance Ratio (NAR) in rural areas of Ethiopia.[8] We can see that NAR increased over the period 2001 to 2014. Although remains low, the ratio of secondary school attendance jumped from below 5 percent in 2001 to 42.3 percent in 2005 before falling back to nearly 6 percent in 2011. There seem to be, however, some improvements in recent years.

[8] The number of primary school age children actually enrolled in primary school divided by the total child population of the same age group.

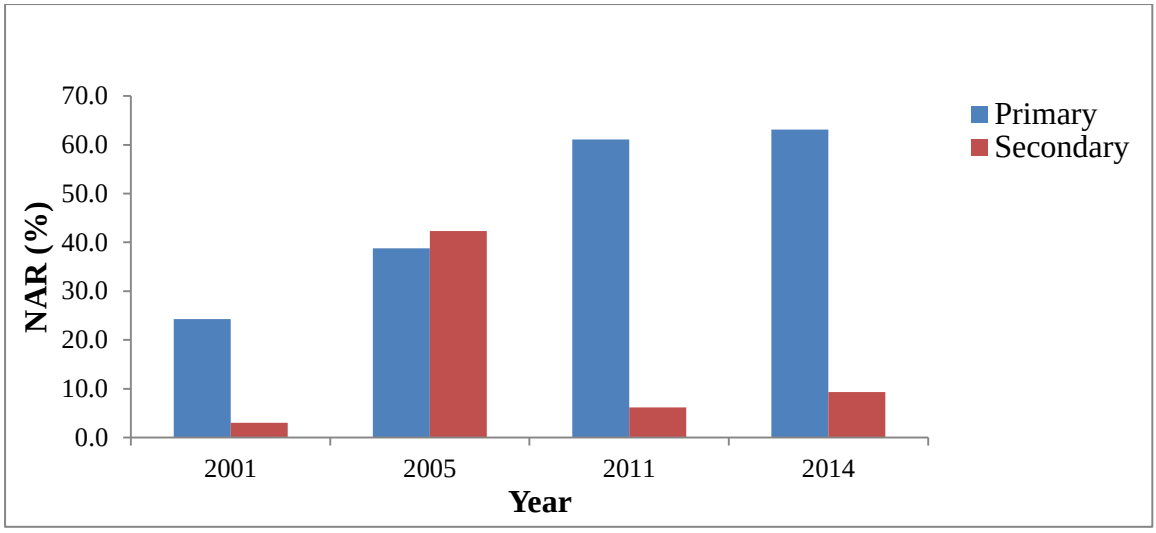


Figure 1 **School net attendance ratio in rural areas**

**Source**: Central Statistical Agency Demographic and Health survey, various years

Rate of primary school attendance also increased in urban areas. Figure 1shows that NAR increased from about 75 percent in early 2000 to about 80 percent in 2014. On the contrary, secondary school attendance declined overtime; from 50 percent in 2001 to nearly 40 percent in 2014. In comparison to rural areas, the rate of attendance is still about 20 percentage points higher in urban areas in 2014. Overall, primary school attendance ratio is nearly 75 percent, whereas secondary school attendance ratio is only 24 percent.

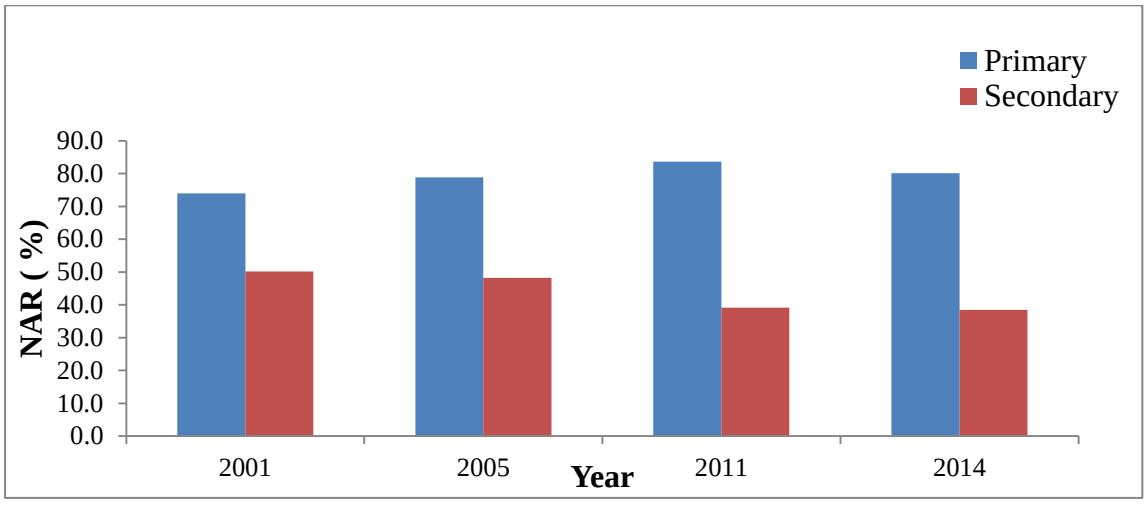


Figure **2 School net attendance ratio in urban areas**

**Source**: Central Statistical Agency Demographic and Health survey, various years

**Error! Reference source not found.** below presents net primary and secondary school ttendance ratio for urban and rural areas by gender. We see some gender differences in school attendance ratio; and the difference is more pronounced in urban than in rural areas. At the beginning of the millennium, primary school attendance ratio of boys was higher than that of girls by about 7 percentage points and 5 percentage points in rural and urban areas, respectively. The data in 2014 shows that, while the gap narrows down in urban areas, more percentage of girls than boys attend primary school in rural areas.

Table 1 **School net attendance ratio** (percent) **by gender**

| | **Rural** | | | | **Urban** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Primary** | | **Secondary** | | **Primary** | | **Secondary** | |
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 2014 | 61.2 | 65.2 | 7.4 | 11.3 | 80.4 | 79.8 | 39.5 | 37.5 |
| 2011 | 60.3 | 61.9 | 6.6 | 5.9 | 85.8 | 81.5 | 43.6 | 36.1 |
| 2005 | 39.1 | 38.5 | 11.9 | 7.3 | 77.8 | 79.6 | 55.3 | 42.3 |
| 2001 | 27.4 | 20.9 | 4.2 | 1.6 | 75.4 | 72.6 | 56.2 | 44.9 |

**Source**: Central Statistical Agency Demographic and Health survey, various years

With regard to secondary school attendance, the gender gap in urban areas has fallen overtime, from more than 10 percentage points in early 2000 to only 2 percentage points in 2014. The data in 2014 shows also that, in rural areas, the percentage of girls attending secondary school is relatively larger than the percentage of boys.

## 3.2 Child Labour

Ethiopia has ratified International Conventions, the ILO's Minimum Age Convention (No.138) and Elimination of the Worst Forms of Child Labour (No.182). These conventions are incorporated into the country's constitution, labour laws and criminal codes. Article 89 (2) of the Labour Proclamation No.377/2003 prohibits the employment of children younger than 14 years of age in any kind of work. In addition, Article 89 (3) of the Labour Proclamation prohibits the employment of children aged 14 to 18 years in activities deemed to be harmful for their health and safety (Federal Negarit Gazeta, 2004).

Despite Ethiopia's approval of anti-child labour laws, the rate of child labour participation remains high. In 2001 the Federal Democratic Central Statistical Authority, hereafter CSA,

conducted a child labour survey, which was regarded as the first in its kind and the most comprehensive study. Results show that about 85 percent of the children, between 5 to 17 years old, were involved in some form of child work during the week before the survey. About 52.5 of working children were involved in child labour, activities deemed to be detrimental to their wellbeing (CSA, 2001).

Table 2 **Rate of child labour participation** (percent) **in Ethiopia**

| | Year | |
|---|---|---|
| Sample Group | 2001 | 2011 |
| Full-sample | 55.20 | 35.00 |
| boys | 62.00 | 48.90 |
| girls | 41.90 | 32.40 |
| urban | 40.00 | 39.35 |
| rural | 49.00 | 16.00 |

**Source**: (CSA & CIF International, 2012; CSA, 2001)

**Error! Reference source not found.** shows that, despite some improvement overtime, the ountry still experienced high incidence of child labour. Survey results show that, while nearly 70 percent of the children aged 5 to 14 years participated in some form of child work in the preceding 7 days before the survey, about 35 percent of them were involved in child labour. During the same period, the average rate of child labour participation for Sub-Saharan Africa was 21 percent (ILO, 2013a).

Child labour participation varies across different groups of children. In terms of gender, for example, the 2001 survey result shows that 62 percent of boys and 41.9 percent of girls were involved in child labour. The 2011 survey shows the gender difference in child labour participation persisted over time. About 48.9 percent of boys participate in child labour compared to only 32.4 percent of girls. There is also a substantial difference in the rates of child labour participation between rural and urban areas. In 2001, about 49 percent of rural children and 40 percent of urban children were involved in child labour; whereas in 2011, about 39.35 percent of children in rural areas participated in child labour compared to only 16 percent of children in urban areas.

Another important feature of child labour in Ethiopia is that family employment is the most dominant source of child labour. Often children help their family in performing domestic chores or working on farms. Paid job is not common among most children. For example, the survey in 2011 shows that only less than 5 percent of children were involved in paid work outside of their own household (CSA & CIF International, 2012).

In terms of determinant factors, resource constraints are believed to be the main driving forces behind the high incidence of child labour in Ethiopia. In urban areas, the need for supplementing household income is the key reason that compels households to send their children to work. In rural areas, on the other hand, child labour is considered as part of households' strategies cope with shortage of labour either to work on farms (Admassie, 2003; Guarcello & Rosati, 2007).

## 3.3 Health Care, Cost of Illness and Coping Strategies

### 3.3.1 Health Care Service

The government of Ethiopia has made a tremendous effort over the last two decades to improve health care services. The nationwide health extension program is one of the major developments observed in the health sector. Initially started in rural areas in 2003 and later scaled up into urban areas, the health extension program was designed to ensure universal access to primary health care. Fully integrated into the country's health system, the program provides 16 clearly defined health care packages constituting preventive, promotive and basic curative services. The services are provided free of charge (Workie & Ramana, 2013). Furthermore, the number of health facilities also increased substantially over the past 10 years. For instance, between 2005 and 2013, the number of public hospitals increased from 79 to 127, the number of health centres grew from 519 to 3,245 and the number of clinics grew 4,211 to 14,416 (World Bank, 2015a).

The health sector has been also under continuous reforms aiming at improving qualities of health care services and health care utilization. Projects that can help build financial capacity and reduce administrative costs have been implemented in public hospitals and health care centres (Ali, 2014). For instance, revenue retention and utilization programs have been put in place to give health care providers discretion in renovating existing facilities and purchasing

new health care facilities and drugs. Outsourcing of non-clinical services such as housekeeping and catering has been introduced to reduce administrative burden and costs so that health care providers would mainly focus on provision of medical treatments. Furthermore, in order to increase health care utilization, the government has introduced fee waiver systems that allow poor individuals obtain basic health care services free of charge (Purvis, Alebachew, & Feleke, 2011).

In spite of the tremendous efforts made by the government, the health sector continues to suffer from critical shortage of facilities and medical personnel. For instance, on average, a health centre, a primary hospital, a general hospital and a specialized hospital serves about 20, 000, 80, 000, 1.25 million and 4 million people, respectively (World Bank, 2015a). Even the existing hospitals and health care centres are poorly supplied with drugs and equipment. Population densities of trained medical personnel in the country are also among the lowest in world. In 2008, the density of nurses and physicians per 1000 population were only 0.2 and 0.03, respectively.

Besides scarcity of facilities, the health system also suffers from inequitable distribution of existing resources. For instance, the three regional states, namely Oromia, Amhara and Southern Nations and Nationalities, while accounting for 80 percent of the country's population, constitute only 38 percent of physicians working in the country. In contrast, about 37 percent of the physicians were working in Addis Ababa, accounting only for 4 percent of the population in the country (WHO, 2013). Rural-urban comparison shows that only 17 percent of medical doctors and 36 percent of nurses work in rural areas of Ethiopia (World Bank, 2012).

Health care financing also remains another major challenge in Ethiopia. Per capita health spending is among the lowest in Africa. For example, in 2014, per capita spending in Ethiopia was only about USD 27, whereas the average for Sub-Saharan Africa was USD 97 (World Bank, 2015c). Health insurance coverage is also at its infancy, only 1.25 percent of the population has access to insurance (MOH, 2014)[9]. As a result, out-of-pocket spending accounts for the lion share of expenditure in the health system. For example, data in 2006 and 2014 shows that out-of-pocket payments accounted for 77.3 percent and 78.1 percent,

[9] Indeed, the government is in the process of initiating health insurance schemes and a community based health insurance is under implementation as a pilot project since 2012 (Alebachew, Hatt, & Kukla, 2014).

respectively of total health care expenditure (World Bank, 2016).[10] This suggests that the fee waiver system introduced in public hospitals and health care centres have been insufficient to address treatment needs.

Out-of-pocket payment may have detrimental effect on health service utilization. Households may try to avoid catastrophic health care expenditures by not seeking treatment. A report by the Federal Ministry of Health (FMOH) of Ethiopia shows that about 40 percent of the population experiencing health illness does not seek treatment. While factors such as distance to health care centres, perception that illness was not chronic and traditional medication are also mentioned reasons for not seeking treatment, shortage of money was mentioned to be the key reason for 41 percent of those who did not seek treatment (FMOH, 2014). This implies that households unable to pay for medical bills might have to suffer from deteriorating health conditions which could have been cured easily (Ali, 2014). This may result in worsening welfare conditions.

### 3.3.2 Health Conditions and Cost of Illness

Ethiopia has shown encouraging progress in improving health. There has been a substantial improvement in child health through delivery of preventive services such as immunization, supply of Vitamin A and insecticide-treated nets. Over the last decade, under-five, infant and neonatal mortality rates, respectively declined by 47 percent, 39 percent and 25 percent (CSA & CIF International, 2012). Data from World Health Organization also show that, for the period 1990 to 2013, maternal mortality declined by 70 percent, from 1400 to 420 per 100,000 live births (WHO, n.d.). There has been also a declining trend in the prevalence of Human Immunodeficiency Virus (HIV), especially among the youth. For instance, between 2001 and 2009, the prevalence rate dropped from 12.4 to 2.6 percent for the population group aged 15 to 24 (CSA & CIF International, 2012).

Nevertheless, various indicators show that poor health remains a national problem. A survey by FMOH shows that 12 percent of the population reported illness episodes in the month

[10] During the same period, the average share of out-of-pocket spending on health care in Sub-Saharan Africa amounted to 54.2 percent and 60.2 percent, respectively

before the survey (FMOH, 2014).[11] With prevalence and incidence rates, respectively of 394 and 261 per 100 000 population, the country stands seventh out of the 22 most affected countries by tuberculosis. Nearly 70 percent of the population is also at risk of malaria infection (WHO, 2013). Measures of loss of Disability-Adjusted Life Years (DALYs), which consists of both the Years of Life Lost (YLL) due to premature death and Years Lost due to Disability (YLD) also shows that Ethiopia has one of the lowest healthy life expectancies in the world. Both for men and women, the estimated healthy life expectancy in 2012 was 9 years lower than overall life expectancy at birth (WHO, 2015).[12]

Widespread disease coupled with limited access to financial protection has made illness one of the most important sources of economic hardships in Ethiopia (Dercon, Hoddinott, & Woldehanna, 2005). A study in Temben district, northern part of Ethiopia, shows that a single incidence of malaria results in loss of labour supply equivalent to 12 to 26 working days and treatment cots amounting 5 percent to 8 percent of households' annual income (Cropper et al., 2000). Another study in Adami Tulu district, southern part of the country, estimates the total cost, including both treatment expenses and loss of working days, of a single incidence of malaria to be about USD 5.60 (Deressa, Hailemariam, & Ali, 2007). Overall, illness has been found to cause substantial loss of productivity and consumption. A study by WHO shows that shows that poor health causes loss of about 45 percent of productive days (WHO, 2013). Chronic illness is also found to compel households to cut consumption expenditure (Asfaw & von Braun, 2004; Dercon & Krishnan, 2000).

### 3.3.3 Self-insurance against Illness

Despite missing formal insurance markets, households in Ethiopia have a wealth of informal risk-sharing mechanisms that can provide protection against health shocks. The three most common indigenous social organizations that exist almost in all parts of the country are *iddir, eqqub* and *debbo. Iddir* is a funeral association which provides assistance either in kind or cash to its members at times of death of a family member. Pay outs are funded by contributions made by members. In recent years *iddirs* have started giving loan or grant to members experiencing other forms of shocks that entail loss of income and labour. *Eqqub* is a

[11] The survey shows also that prevalence rate was higher among women, 13 percent, than men, 11 percent and urban residents, 14 percent, than rural residents, 11 percent.

[12] Diseases such as lower respiratory infection, diarrheal diseases and HIV are reported to be the three leading causes of morbidity and mortality in the country

rotating credit and saving association primary established to mobilize savings and working capital. Members should contribute a fixed amount of money on a regular basis, often weekly. While benefit is received in a lump sum payment on rotation basis, members facing financial difficulties will be given priority to receive funding. Unlike the first two, *debbo* is a labour sharing arrangement between members with the aim of working together often in agricultural activities, such as ploughing, weeding and harvesting (Hoddinott, Dercon, & Krishnan, 2005; Krishnan & Sciubba, 2009).

Evidence shows that most households in Ethiopia are members in at least one of the three social groups (Di Falco & Bulte, 2013). However, entry into social networks could depend on some factors. Among others, wealth and household size are the most important factors that determine membership status. Wealthier and larger families are more likely to be members in more than one social organization because of their ability to make monetary or labour contributions (Hoddinott et al., 2005). In addition, the networks operate based on principles of reciprocity and failure to fulfil such commitments may result in social exclusion from forming social groups in the future (Krishnan & Sciubba, 2009). This implies that households experiencing chronic illness may refrain from seeking assistance if they fear that they may not be able to reciprocate in the near future.

Studies that specifically investigate households' response to illness show that households use a mix of strategies to cope with financial risks of ill health. For instance, Dercon and Krishnan (2000) find risk sharing within the household. When the family experiences illness, women cut their consumption so that other household members would have enough to consume. On the other hand, a recent study notes that food consumption doesn't respond to health shocks. When faced with illness, households neutralise financial risks using dissaving, sale of assets, borrowing from informal sources and seeking support from relatives and friends (Yilma et al., 2014). Their findings show that households experiencing shocks are about 17 percentage points more likely than other households to draw on savings and sell assets.

# 4. Data and Descriptive Statistics

The study uses data from Young Lives survey. Young Lives is a research project on child poverty in Ethiopia, India, Peru and Vietnam conducted by a team based at the University of Oxford in collaboration with governmental and non-governmental organisations in the partner countries. Starting from 2002 the project has been tracking the changing lives of 3000 children in each country. The sample in each country consists of two groups of children: the young cohort and the old cohort. When the project started in 2002 the former consisted of 2000 children aged 6 to 18 months and the latter consisted of 1000 children aged 7.5 to 8.5 years.

We restrict our analysis to the survey in Ethiopia. Using a mix of random and non-random sampling techniques, Young Lives draws the index children in Ethiopia from 20 sentinel sites. First, five regions, namely Addis Ababa, Oromia, Amhara, SNNPR (Southern Nations, Nationalities and Peoples Region) and Tigray were selected. The regions constitute more than 96 percent of the population in the country. Next, taking population size into consideration, three to five districts were selected from each region. While takes cultural, geographical and livelihood differences into account, the survey oversamples poor and food-deficient areas of the regions.[13] Then, one village was randomly selected from each district given that the village has at least 100 and 50 households, respectively having children with the right age for the young and old cohorts. Lastly, 150 households were randomly selected within each village (Outes-Leon & Sanchez, 2008).

Although Young Lives sampling method has never been nationally representative, it has several attractive features. First, the survey generates a large enough sample for general statistical analysis and ‘an in-depth study of relationships between pieces of information regarding child welfare and the economic environment (Wilson, Huttly, & Fenn, 2006). Unlike most household surveys, Young Lives gathers information on how children’s time is allocated between alternative activities such as sleeping, playing, studying, schooling and work. Second, children from the age of 8 are directly asked about their perceptions of well-being, the activities they perform on a particular day, whether they face difficulty in

[13]About 75 percent of the households in the sample are selected from districts with chronic food shortages and the rest from districts with low incidence of food insecurity. However, for the sake of comparison the other 25 percent were selected from non-food insecure areas.

reconciling work and schooling, whether they have a say in time allocation decisions and how they are treated by others. Since some child work activities may be socially or legally sensitive and they could be underreported by adults (Tafere, Abebe, & Assazinew, 2009), directly interviewing children allows them children express their working lives from their own perspectives.

Third, the time gap between each survey round is sufficiently large to observe both systematic and random changes in the lives of children. Fourth compared to other similar longitudinal studies, Young Lives has very low attrition rates, only 2.7 and 3 percent for the young and old cohorts, respectively. Death is found to be the most important cause for attrition among the young cohort; whereas refusal and migration are the most important reasons for the attrition among old cohort. Outes-Leon and Dercon (2008) find that the attrition is purely a random phenomenon.

We use data from the 2006 and 2009 survey rounds. We restrict our analysis to 2269 children, 1299 from the young cohort and 970 from the old cohort. Because we excluded children younger than 5 years as they are not expected to perform work activities. International conventions on child labour and children's right also define the child population as people aged 5 to 17 years (ILO, 1973; UN, 1989). In addition, since we are interested in estimating effects of illness of the mother and the father on allocation of children's time, we consider only children with both parents live in the family.[14].[15]

As a study of child welfare, the surveys in 2006 and 2009 provide a wealth of information on child, household and community characteristics. The child questionnaire module covers topics related to children's education, health and time use. The household context survey covers topics such as demographic characteristics, consumption expenditure, asset ownership, livelihood activities and exposure to shocks. Community level information includes development and availability of social and economic infrastructures and exposure to aggregate shocks that might have direct effects on parental health and time allocation decisions.

[14] However, they may not necessarily be the biological parents of the index children. We consider the household head and the spouse as parents. As discussed in sub-section 4.2.3, we control for absence of biological parents.
[15] Outes-Leon and Dercon (2008) have already examined whether attrition is systematically related to an array of child and household observable characteristics and found it is random. Thus we do not test for attrition bias in this study.

Information on children's time use is provided in Table 3. Apart from sleeping, child time in a particular day is allocated to activities such as playing, schooling, domestic chore and market work. Under the United Nations System of National Accounts (SNA) market work falls under the category of 'economic work'. However, the term 'economic work' is less commonly used in much of the academic literature as it implies that domestic work is non-economic. Therefore, to be consistent with the literature, we define market work as activities that children perform for other households and activities that they perform for their own family outside the house such as, street vending, work on farms or attending shops of their own family. On the other hand, domestic chore refers to activities children perform for their own household inside the house such as washing, cooking, cleaning and caregiving (UN, 2009).

Table 3 **Number of hours** (mean) **allocated to alternative activities**

| | Survey Round | | | |
|---|---|---|---|---|
| | 2006 | | 2009 | |
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Time allocation (in hours) to: | | | | |
| play | 6.40 | 4.12 | 3.78 | 2.18 |
| school | 4.40 | 4.01 | 6.60 | 3.03 |
| domestic chore | 2.82 | 1.89 | 3.01 | 1.89 |
| market work | 1.00 | 1.84 | 1.61 | 2.38 |
| Obs. | 2269 | | 2269 | |

*Note:* Time to school includes time use both for school attendance and studying.

Referring to the second and forth columns of Table 3, parents seem to allocate more time for non-work activities. In 2006, playing takes the largest share of children's time. This could be because most of the children were too young to go to school and possibly to engage in child work. While the official age for starting primary school in Ethiopia is 7 years, all the children in the young cohort were younger than 7 years. As a result, only 27 percent of them were enrolled in school. Including the old cohort, about 56 of children in the sample were enrolled in school in 2006. On the other hand, data in 2009 show that more time is allocated to school than to play. Average time spent in, market work is also larger than time spent in domestic chores. This suggests that children are more likely to do market work and go to school as they

get older. Young Lives survey shows that close to 85 percent of children were enrolled in school in 2009, which is about 30 percentage points higher than the rate in 2006.

On the other hand, Table 4 shows that, in 2006 and 2009, respectively about 90 and 98 percent of children in our sample participated in child work in one way or another. There is huge difference, however, in the rates of participation between market work and domestic chore. In 2006, while only 30 percent of children participated in market work, 90 percent of them participated in domestic chore. Similarly, in 2009, participation in market work was just below 45 percent, whereas participation in domestic work was 95 percent.

Table 4 **Participation rates** (percent) **in child work and child labour across gender**

| | Survey Round | | | | | |
|---|---|---|---|---|---|---|
| | 2006 | | | 2009 | | |
| Activity | Boys | Girls | Total | Boys | Girls | Total |
| Market work | | | | | | |
| Rate of participation (%) | 37.96 | 22.63 | 30.28 | 56.89 | 27.14 | 42.93 |
| Hours spent | 1.34 | 0.61 | 1.00 | 2.36 | 0.75 | 1.61 |
| Domestic work | | | | | | |
| Rate of participation (%) | 89.5 | 90.52 | 89.69 | 93.19 | 98.59 | 95.72 |
| Hours spent | 2.53 | 3.14 | 2.82 | 2.91 | 3.82 | 3.01 |
| Child labour : | | | | | | |
| Rate of participation (%) | 55.73 | 54.37 | 55.09 | 53.08 | 54.27 | 54.63 |
| Obs. | 2204 | 1065 | 2269 | 2204 | 1065 | 2269 |

The low rates of participation in market work seem to mask the average number of hours allocated to the activity. Considering all children in the sample, average number of hours in a day allocated to market work is only 1 hour in 2006 and 1.6 hours in 2009. Conditional on participation, average hours spent on market work in a day increased from 3.3 hours in 2006 to 3.8 hours in 2009. Nevertheless, conditional on participation, the average daily time allocated to domestic chore remains around 3 hours per day.

Another important variable of interest in **Error! Reference source not found.**is child labour. rom the perspective of children's welfare child labour is distinct from work. Child labour

refers to activities that interfere with children's education, deprive their childhood and harm their mental and physical development (ILO, 1973; UN, 1989). This implies that not all form of child work is harmful to children. Indeed, depending on their age and the type of task they perform, children may benefit from participation in light work. While working, children may even acquire skills useful for their future life or earn income that can be used to meet their educational and health needs (Cigno & Rosati, 2002; Moehling, 2005). Even from human rights perspective, participation in some work activities is permissible as far as the tasks are harmless to child welfare (ILO, 1973).

However, the statistical definition of child labour remains an important subject of discussion and disagreement. The empirical literature highly suffers from heterogeneity in defining child labour. While some define child labour as participation in market work (Bandara, Dehejia, & Lavie-Rouse, 2015; Emerson & Souza, 2003; Patrinos & Psacharopoulos, 1997; Ray, 2000), others define it as participation both in market and domestic work (Edmonds & Pavcnik 2005; Putnick & Bornstein, 2015; Reggio, 2011).

To resolve the ongoing confusion in defining child labour, in 2008, the 18th International Conference of Labour Statisticians set a standard for statistical measure of child labour. The resolution sets two important guidelines to address the problem. First, it identifies children aged 5 to 17 to be the target population for child labour data collection. Second, it proposes statistical concepts and definitions of child labour to include all productive activities that fall within the general production boundary as defined by the United Nations System of National Accounts (ILO, 2008). The resolution reaffirms application of the provisions of ILO's Convention No. 138, which stipulates the minimum age for admission to employment (ILO, 1973) and Convention No. 182, which calls on elimination of the worst forms of child labour (ILO,1999)[16] to the statistical definition of child labour. Accordingly, the resolution treats participation in household chores for long hours and under hazardous conditions as child labour.

In this regard, UNICEF's has already developed a statistical definition of child labour. The definition is consistent with legal frameworks and labour standards set by international conventions and the guidelines proposed by the resolution of the '18th International

[16] Worst forms of child labour refer to participations in hazardous activities such as prostitution, pornography, armed conflict as well as debt bondage.

Conference of Labour Statisticians'. According to UNICEF, a child is said to be in child labour if: at the age of 5 to 11yeras spends 28 hours of household chore or one hour of market work per week; at the age of 12 to 14 years spends at least 14 hours of market work or 28 hours of household chore per week; at the age of 15 to 17 years spends at least 43 hours of household chore or market work per week (UNICEF, n.d.).

We follow UNICEF's approach to define child labour. Accordingly, the lower part of Table 4 shows that about 55 and 54 percent of children participate in child labour in 2006 and 2009, respectively. Nevertheless, our measure of child labour does not include participation in the worst forms of child labour, as stated by the ILO's Convention No.182. Thus it shows only the lowest possible prevalence of child labour among sample children.

Table 5 **Prevalence rate** (percent) **of negative events**

| | 2006 | | 2009 | |
|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Self-report threats(yes/no): | | | | |
| mother ill | 0.28 | 0.45 | 0.35 | 0.48 |
| father ill | 0.22 | 0.41 | 0.21 | 0.41 |
| other members ill | 0.25 | 0.43 | 0.29 | 0.46 |
| death of livestock | 0.25 | 0.44 | 0.30 | 0.46 |
| crop failures | 0.21 | 0.41 | 0.26 | 0.44 |
| theft | 0.13 | 0.34 | 0.10 | 0.30 |
| job loss | 0.10 | 0.30 | 0.11 | 0.31 |
| forced eviction | 0.03 | 0.18 | 0.04 | 0.20 |
| Obs. | 2269 | | 2269 | |

Note: Individuals considered as the mother and the father in a household are not necessarily biological parents of index children. Rather they represent the household head and spouse. We have included in our regression models dummies showing whether the biological father and mother live in the family.

Information on households' exposure to parental illness is presented in Table 5. In addition to illness of the mother and the father, we summarise households' exposure to an array of negative events that might have affected time allocation and child labour decisions. In 2006 and 2009, respectively about 28 percent and 35 percent of households reported that they experienced illness of the mother in the previous three years before the survey. Over the same

time period, relatively fewer households reported experience of deterioration in the health of the father. The proportion of households experienced death of livestock and illness of other household members is similar, close to 25 percent and 30 percent in 2006 and 2009, respectively. The effect of crop failure seems to be also common among households. More than 20 and 25 percent of the sample households reported exposure to crop failures in 2006 and 2009, respectively. On the other hand, shocks such as theft, job loss and forced eviction seem to be less common threats among sample households.

As discussed in section 2, the effect on time allocation of parental illness depends, among other things, on severity of illness episodes. While some illnesses can be easily cured without having major welfare consequence, others can lead to serious disability conditions and entail catastrophic treatment expenditures. In each round of Young Lives survey, without prompting for detail explanation about the severity of illness and its economic effects, the questionnaire simply asks respondents whether or not the household experienced illness of the mother or the father since the visit in the previous survey.[17] Thus our measure of ill health may reflect both unexpected and transitory deterioration in health and chronic illness that might have lasted for long time.[18]

The robustness of our estimates depends on how well the self-reported illness reflects actual health status. In this regard, the reliability of self-reported health status in predicting clinical results remains a subject of considerable discussion and disagreement in the empirical literature. Some argue that self-reported illness may suffer from reporting bias (Genoni, 2012; Gertler & Gruber, 2002; Gertler, Levine, & Moretti, 2009). The argument is measurement is based on respondents' perception of illness and different people can have different perception about same health status. A healthy condition for some people may be unhealthy condition for others

Nevertheless, self-reported illness remains a popular measure of health status in the empirical literature (Asfaw & von Braun, 2004; Dercon & Krishnan, 2000; Islam & Maitra, 2012; Smith, 2005; Sparrow et al., 2014). Indeed, it can be a valid measure as long as health assessment criteria are the same across individuals and they are free from confounding effects

[17] Page 75 and 85of the questionnaires for the 2006 and 2009 survey, respectively.
[18] However, since our identification strategy depends on variations overtime in parental health status, permanent deterioration in health conditions would be controlled by the fixed effects estimation.

of socio-cultural factors. It has been argued that self-reported health captures different dimensions of health and it is a reliable predictor of mortality and morbidity (Grau, West, & Gregory, 1998). Using tetrachoric correlation to examine the relationship between self-reported measures of arthritis and clinical measures Butler, Burkhauser, Mitchell, and Pincus (1987) find that the two measures are strongly correlated. The authors also conclude that self-reported illness indicates actual health status. Rosen and Taubman (1982) note that self-reported health status helps predict objective measures of health status. Using a unique dataset from the US, they find that 23 percent of those who reported worse health condition in 1969 died in 1973, while only 7 percent of those reported better health dies during the same period.

Recent evidence strengthens the argument that self-reported illness reflects actual health status. Using data from 40 Low and Middle Income Countries (LMICs), Kruk, Goldmann, and Galea (2009) finds that catastrophic medical spending is strongly related to self-reported illness. In most developing countries, due to limited access to health insurance, households have to cover the cost of medical care through out-of-pocket payments (Wagstaff, 2007). Thus, they may not seek treatment and spend money unless illness is chronic. This suggests that the finding by Kruk et al. (2009) confirms that self-reported illness predicts actual health conditions.

Furthermore, using data from Indonesia, Sparrow et al. (2014) find that self-reported illness has significant effect on out-of-pocket payment. They also find similar consumption smoothing behaviour of households when they use self-reported illness and number of days lost due to illness, which is believed to be a more objective measure of health status. Similarly, using longitudinal data from Bosnia and Herzegovina for their assessment of the effect of parental illness on school enrolment, Bratti and Mendola (2014) find no significance difference between estimates obtained with measures of self-reported illness and activities of daily living.

Data on additional control variables that represent a range of child, household and community characteristics is presented in Table 6. In terms of gender composition, almost half of the children in the sample are female. The values of average age of children and highest grade they achieved seem to be compatible. Given that the official age of entry into primary school is 7 years, we expect children aged 8 and 11 years to achieve first and third grades,

respectively. On the other hand, data on parental education shows that majority of parents have little or no education: most of them are even unable to complete primary education. Another important point worth mentioning is that not all children live with their biological parents. In 2006 and in 2009, respectively about 86 percent and 81 percent of children live with their biological mother. During the respective periods, however, only 69 and 62 percent of children live with their biological father.

Table 6 **Summary statistics of additional explanatory variables**

| | Survey Round | | | |
|---|---|---|---|---|
| | 2006 | | 2009 | |
| | 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 |
| child sex | 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 | 34.93 | 8.49 | 37.70 | 8.35 |
| father's education | 2.77 | 4.16 | 2.95 | 4.10 |
| biological father | 0.69 | 0.46 | 0.62 | 0.49 |
| father's age | 43.86 | 10.89 | 46.52 | 10.94 |
| Household Characteristics | | | | |
| mother's power | 0.457 | 0.281 | 0.458 | 0.276 |
| head sex | 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 in 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 |
| Obs. | 2269 | | 2269 | |

Household level data shows that majority of households are male headed. However, based on our measure of balance of power, there seem to exist a balanced power between the mother

and the father. Households have large family size, on average about 6 people live in each family. Most of the households in the sample are members in at least on social organisation and they own animals. Most of them also live in communities with access to microfinance institutions and health care centres. However, land resource seems to be scarce. On average, households own less than 1 hectare of land. Our measure of wealth index also suggests that most households in the sample are vulnerable to poor living conditions. In addition, a high proportion of them reside in communities experiencing livelihood threats such as drought and flood.

# 5. Conceptual Framework and Empirical Estimation

## 5.1 Conceptual Framework

Parental illness can affect allocation of children's time through different ways. Directly, children may be required to provide supportive care for the ill parent. If caregiving is a full time task, children may have little or no time for leisure activities. Indirectly, loss of income and labour to illness may affect parental preference towards child work and schooling. For instance, when the mother suffers from poor health and unable to perform household chores, children may be required to step in and take over their mother role. Similarly, children may be required to go to work to supplement household income when the main breadwinner, often the father, is ill.

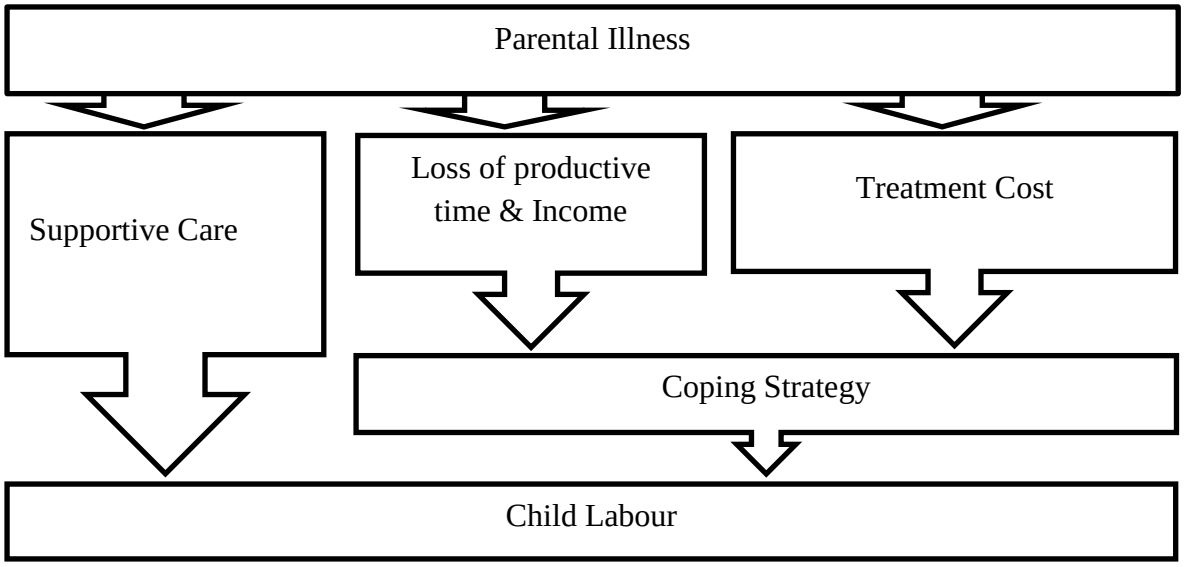


Figure 3 **Parental illness, child labour and transmission mechanism**

As shown in Figure 3 another indirect channel through which parental illness affects child time are catastrophic treatment costs, mainly in the form of out-of-pocket payments. Unless households have financial protection or they forgo treatment, spending on curative care may absorb a substantial share of their budget. As a result, households would be left with meagre resources to spend on other pursuits. This may compel them to shift child time from leisure to work.

We draw on prior literature to establish a mathematical relationship between parental illness and time allocation decision outcomes. Adopting the 'Luxury and Substitution Axioms' of Basu and Van (1998), we assume that parents behave altruistically towards their children and child labour can substitute adult labour and parents altruistically behave towards their children. The substitution axiom implies that children can assume their parents' roles when parents are away from their usual duties. This seems to be a plausible assumption in the case of Ethiopia, where majority of the people have little or no education thus child labour may easily substitute unskilled labour.[19] The 'luxury axiom', on the other hand, implies that parents derive utility from their children's leisure time and they consider child work as undesirable as it entails forgone benefits from leisure. As a result, unless beneficial to children's welfare,[20] time will not be allocated to work when the family has enough income to meet basic needs. Altruistic parents send their children to work only if faced with shortage of labour or financial resources to meet basic needs.

Consistent with the literature we treat allocation of children's time as part of households' utility maximisation objective. Time spent in leisure activities, including schooling, enters into households' utility function, whereas time spent in work enters into their budget constraint. On the other hand, health can be considered both as a consumption and investment commodity. As an investment good, health enters the household's budget constraint because it can determine the amount of time available for production of money income and commodities (Grossman, 1972). Indeed, as shown in Figure 3, health can also be treated as a consumption good enter into households' utility function; because illness gives disutility. In addition, if treatment is sought, health can compete with other consumption goods for the household's budget allocation: money and time spent for improving health can affect resources to be available for consumption of other goods (McClellan, 1998). To make the analytical model simple, however, we treat health only as an investment commodity.

[19] Children may not also have the required skill and physical ability to fully compensate for lost adult labour to illness. Their participation in some work activities may require supervision by adults, implying some form of complementarity between children and adults (Diamond & Fayed, 1998).

[20] In some cases, children may work simply because parents believe that work entails learning skills that are useful for children's future life as adults (Basu et al., 2010). On the other hand, selfish parents might be less concerned about welfare of their children and treat them as saving vehicles. Accordingly, children may be subject to work and enjoy little or no leisure time as long as there is demand for their labour (Gupta, 2000; Parsons & Goldin, 1989). This implies that parental illness would have a very weak increasing effect on work hour, or may even increase leisure time

Assume a household with two parents and a school age child. We assume parents derive utility from consuming goods and their child's education. One possibility to define decision making process in the household is to consider a unitary model whereby the household is treated as if it were a single decision making unit (Becker, 1965). However, unitary models of the household attract much criticism in the empirical literature with the ground that they overlook conflict of interests and non-cooperation between household members (Basu, 2006; Browning & Chiappori, 1998). Therefore, to capture possibilities for diverging preferences between parents in choosing their consumption baskets or each parent has its own say, we assume decision making in a collective framework.

Following Basu (2006), we assume that the father and the mother have different preferences towards consuming goods, say the mother prefers vegetable and the father prefers meat. In a general setting, we can write the father's preferred good as $x_1$ and the mother's preferred good as $x_2$. Given parental altruism, both parents have similar preference when it comes to their children's education $s$. They believe that the child's education is desirable and derive utility from it. Accordingly, the household's utility function is defined as a weighted sum of each parent's private utility and utility from their child's education as. The weights represent the bargaining powers of the parents.

$$U = \varphi u_1(x_1) + (1 - \varphi)u_2(x_2) + b(s) \quad (1)$$

where $u_1(x_1)$, $u_2(x_2)$ and $b(s)$ are strictly increasing concave functions; $0 \leq \varphi \leq 1$ and reflects the balance of power in the family. A generic form of unitary models of the household can be obtained from (1) when there is polarised power relation between parents; when either $\varphi = 1$ or $\varphi = 0$ . For example, at φ=1, the mother has to fit her preference with the preference of the father and the utility function will be reduced to $U = u_1(x_1) + b(s)$.

The objective of the household is to maximise (1) subject to budget and time constraints. Theoretically, the household may have labour and non-labour income. In the context of Ethiopia, however, households' livelihood heavily relies on labour income. More than 80 percent of the population in the country depends on subsistence agriculture, where production involves labour intensive technologies like ploughing using draft animals. In urban areas, employment is mainly in the informal sector, where labour is still the key factor of

production. Most households have extremely limited access to non-labour income sources such as government transfer, income from capital investments or savings. Even participation in government social protection schemes such as the well-known Productive Safety Net Programme (PSNP), the largest safety net program in the country, requires labour contribution for construction of public infrastructures (Hoddinott, Berhane, Gilligan, Kumar, & Taffesse, 2012).

While modelling time allocation decisions, it is customary to assume that an individual allocates total time between work and leisure. In this context, we can think of that parents spend a faction of their time in leisure activities. Nevertheless, without loss of generality, we assume that parents always prefer work to leisure. Indeed, given the state of poverty in which most households in Ethiopia live, it seems plausible to assume leisure is no worthwhile for parents. While both parents may always prefer work to leisure, their role in the family may be different. In Ethiopia, the mother mostly takes responsibility for childcare and other domestic activities, whereas the father is primary responsible for doing income generating activities. However, it is also common to see women working on farms and running small family businesses.

We allow the amount of time that each parent spent in producing money income or household commodities to depend on their health status. Parents experiencing chronic illness will have fewer hours of work in a day and can lose part of their income(Grossman, 1972).[21] On the contrary, improvement in parental health status can lead to increase in labour supply and result in higher income (Gertler & Gruber, 2002; Thomas & Strauss, 1997; Wagstaff, 2007).

Consistent with differences in their role, suppose wage rates for the mother and the father are different, total parental income of the household takes the form:

$$y_p = \sum w_i \, t_i(h_i) \qquad (2)$$

[21] Indeed causality may also run from labour income to health (Deaton & Paxson, 1998). The purpose of our study is not, however, to tackle the causality issue; rather to shed some light on the theoretical link between income effects of health and time allocation decision outcomes.

where $y_p$ is parental income of the household; $i$ indexes each parent; $w_i$ and $h_i$, respectively are wage rate and health parameter of parent $i$;[22] and $t_i(.)$ is assumed to be a linear function determining each parent's productive time and $\frac{t_i}{h_i} > 0$.

Another source of labour income to the family is child work, especially when parental income is insufficient to meet consumption needs. Although the labour market in Ethiopia is inadequately developed, it is customary to observe children working for other households (Krishnan & Sciubba, 2009). Accordingly, suppose child income is determined as:

$$y_c = w_c * l \tag{3}$$

where $y_c$ is child income; $w_c$ is child wage rate;[23] $l$ represents time spent in work.

Assume total household income is used to finance consumption of goods and child education, the budget constraint will be:

$$y_p + y_c = p_1 x_1 + p_2 x_2 + es \tag{4}$$

where $p_1$ and $p_2$, respectively are price of $x_1$ and $x_2$; $e$ measures per unit cost of time spent in school.[24]

Unlike in Basu (2006), the utility function in (1) is subject to an additional constraint, the available child time to be allocated between alternative activities. In a particular day, a child's time can be allocated to various activities such as sleeping, playing, schooling and work. However, it is customary in the literature to consider all non-work activities including schooling as leisure (Baland & Robinson, 2000; Basu & Van, 1998; Rogers & Swinnerton, 2008). Given that attendance in public school in Ethiopia is free, we would expect the direct cost of schooling to be less important for time allocation decision. Rather opportunity cost of school attendance, in the form of forgone benefit from work, can be more important (Woldehanna & Hagos, 2012). This implies that, from the perspective of the family's

[22] When parents are self-employed, wage rate is assumed to be a measure of their productivity.
[23] As in the case of the parents, when children work for own family, $w_c$ represents marginal productivity.
[24] $e$ exceeds $w_c$ an amount equivalent to direct costs of schooling such as tuition fee and cost of stationary.

welfare, time allocated for school should not be more costly than time allocated for play. In fact, if parents have optimising behaviour regarding allocation of children's time, they will allocate time between different activities until marginal return from each activity becomes equal (Edmonds, 2008).

For the sake of mathematical brevity and simplicity, we define time constraint of the child as:

$$t_c = l + s \tag{5}$$

where $t_c$ is total available time; $l$ and $s$ are already defined in (1) and (3).

The relationship between parental illness and time allocation decisions is, therefore, established within the household's objective of maximizing (1) subject to (4) and (5). From the First Order Conditions (FOCs), shown in Appendix *I*, we find that :

$$l_p \equiv w_c\lambda_1 > \lambda_2 \tag{6}$$

$$s_p \equiv \frac{\partial b(s)}{\partial s} < c\lambda_1 + \lambda_2 \tag{7}$$

Equation (6) and (7), respectively provide the criteria for decision whether or not the child should work. Equation (6) shows that the child works if wage is greater than the shadow value of time spent in alternative activities, in this case schooling. Similarly, from (7), we see that if the marginal benefit from schooling is less than the sum of marginal costs, both direct and indirect costs, associated with additional time spent in school, children will not go to school.

We use total differentiation of the FOCs to derive the relationship between parental health and time for work and leisure. Accordingly:

$$\frac{ds}{dh_i} = \frac{(e+w_c)*\varphi u_1''(x_1)*(1-\varphi)u_2''(x_2)*w_i t_i'(h_i)}{b''(s)[p_1^2(1-\varphi)u_2''(x_2)+p_2^2\varphi u_1''(x_1)]+(e+w_c)^2\varphi(1-\varphi)u_1''(x_1)u_2''(x_2)} \tag{8}$$

Given the assumption stated under (1) and (2), the numerator in (8) is always positive. In addition, given that $u''(x_2) < 0$, $u''(x_2) < 0$ and $b''(l) < 0$, the denominator in (8) and $\frac{ds}{dh_i}$ become positive . This implies that, other things being constant, time for schooling increases with improvement of parental health status. In the words, children will spent less time in school when their parents experience deteriorating health conditions.

On the contrary, given the assumptions stated above, the denominator in (9) and $\frac{dl}{dh_i}$ become negative. This implies that time for child work falls with improvement in parental health. In other words, the amount of time the children spend in work activities increases when their parents are ill.

$$\frac{dl}{dh_i} = \frac{(e+w_c)*\varphi u_1''(x_1)*(1-\varphi)u_2''(x_2)*w_i t_i'(h_i)}{-b''(s)[p_1^2(1-\varphi)u_2''(x_2)+p_2^2\varphi u_1''(x_1)]-(e+w_c)^2\varphi(1-\varphi)u_1''(x_1)u_2''(x_2)} \quad (9)$$

Notwithstanding appearing in (8) and (9) as a determinant of time allocation, health can be endogenously also determined by behavioural choices. Health stock at a given period can depend on the extent to which people engage in healthy lifestyle such as dietary choice, immunization, physical exercise and utilization of curative medical care (Grossman, 1972; Strauss, Gertler, Rahman, & Fox, 1993; Wagstaff, 1993). Choices of inputs and their utilization in turn depend on factors such as price, availability of health infrastructures and demographic and socioeconomic characteristics of households (Leibowitz, 2004). Indeed, people may also experience deterioration in health due to random shocks that are out of their control. For example, car accidents or natural disasters such as floods, drought and earthquakes can cause severe health risks (Dupas, 2011).

Suppose parental health status at a given time is determined as:

$$h_{it} = h(z_{it}, \eta_i, \xi_{it}) \quad (10)$$

where is $h(.)$ is assumed to be linear in specification; $z_{it}$ is a vector of time-varying parental and household characteristics; $\eta_i$ individual fixed effects; and $\xi_{it}$ random health shocks.

## 5.2 Empirical Estimation

The most common empirical challenge in estimating time allocation models is to balance between competing issues. First, decision on allocation of children's time between alternative activities can be made jointly. For example, a decision to allocate more time to school can be a simultaneous decision to allocate less time to work. This implies that error terms across different time use equations could be correlated. Second, often time diary data have excessive zeros and estimation process may require controlling for inflated zeros. Third, time allocation preference of households can be affected by a range of unobserved child, household and community characteristics. Thus consistency of estimation results requires accounting for unobserved heterogeneities.

Unfortunately, we cannot address all the issues with a single estimation technique. Thus we need to consider the most serious issue. Indeed, we can still get unbiased estimates from estimating each time use equation separately but would undermine their efficiency. Even improving efficiency of the estimates with joint estimation requires satisfying exclusion restriction assumptions. However, in our case it is difficult to think of a factors affecting time allocation to one activity without affecting allocation to another activity. Thus joint estimation may not be helpful anyway.

Furthermore, although our time diary data shows a substantial number of zeros in the case of time use in school and market work, there is little theoretical evidence suggesting that the zeros have structural feature. Two possible reasons associated with excessive zeros in the case of time spent in school are either children were too young or chronically ill to go to school (Biggeri, Guarcello, Lyon, & Rosati, 2003). Chronic illness could also hinder children from spending non-zero hours in market work.

Young Lives survey shows, in 2006, only 10.01 percent of children in the sample were reported to have worse health condition than other children. While about 54.61 percent of children were reported to be as healthy as other children, 33.38 percent were reported to have better health than other children. In 2009, 42.06 children were reported to have the same health status as health status of other children, whereas 47.24 percent were reported to be in better health conditions than other children. Still only 10.70 percent of children were reported

to have worse health than other children. This implies that chronic illness may not explain the excessive zeros observed in the data. In the case of estimating schooling, we can address the issue by excluding children younger than 7 years, the official age to start primary school.

A most important issue to address in our empirical estimation is bias arising from unobserved heterogeneity. The fact that health is a choice implies that parental illness may be endogenous to allocation of children's time. Unobserved parental characteristics that affect parent's engagement in healthy lifestyle may be also correlated with allocation of children's time. For example, parents heavily discounting future returns from investments in human capital may also underinvest in their own health and their children's education (Farrell & Fuchs, 1982). Less investment in school also implies a shift in child time from schooling to work. Therefore, we take advantage of the panel nature of our data and fit fixed effect models.[25]

### 5.2.1 Effects on Time Allocation

We apply Fixed Effects Poisson (FEP) model to estimate the effect of parental illness on children's time allocation. Although FEP is commonly used for count data, it also works well for data with nonnegative and continuously distributed outcome variables (Manning & Mullahy, 2001; Mihaylova, Briggs, O'Hagan, & Thompson, 2011; Wooldridge, 2010). Consistency of parameters requires only correct specification of the conditional mean (Wooldridge, 1995). Individual fixed effects can be successfully eliminated from FEP using conditional Maximum Likelihood estimator. This also helps control for factors causing overdispersion in our data in (Cameron & Trivedi, 2009). Even when individual fixed effects are not responsible for overdispersion, we can still get more robust estimates using cluster-robust standard errors (Wooldridge, 2010).

Suppose the conditional mean is specified as:

$$E(y_{ijt}|h_{it}^{m};\ h_{it}^{f};\ x_{itj};\ \eta_i) = exp(\gamma_1 h_{it}^{m} + \gamma_2 h_{it}^{f} + x_{ijt}'\beta + \eta_i) \quad (11)$$

[25] Since only one child is sampled from each household, the approach helps control for both child and household fixed effects.

where $h_{it}^{m}$ and $h_{it}^{f}$, respectively stand for measures of illness of the mother and the father;[26] $\gamma_1$ and $\gamma_2$ are parameters of interest measuring the effect of illness of the mother and the father, respectively; $x_{ijt}$ is a vector of observable time-varying child, household and community characteristics; $\beta$ is vector of parameters corresponding to observable covariates; $\eta_i$ is a measure of unobservable fixed effects.

In our fixed effects model, identification of $\gamma_1$ and $\gamma_2$ comes from within variation in parental health status. Thus consistency of the estimates rests on the assumption that $\eta_i$ is the only source of unobserved heterogeneity. Once we control for all observables and time invariant unobservables, any improvement or deterioration in parental health status is assumed to be exogenous to allocation of children's time. Indeed, whether the assumption is plausible or not remains an empirical challenge.[27] If parental illness correlates with time-varying unobervables that also affect allocation of children's time, $\gamma_1$ and $\gamma_2$can still be inconsistent.

Although we cannot be certain what kinds of unobserved factors would change overtime and affect both parental illness and time allocation decisions, we can reasonably handle heterogeneity problems in our fixed effects model by controlling for all relevant factors. In case the heterogeneity arises from unobserved changes at community level, we can include interaction terms between time fixed effects and community fixed effects. We can also control for shocks that can affect all members of the household. For example, shocks such as crop failures, death of livestock, drought and flood may simultaneously affect parental health and allocation of children's time. Similarly, outbreak of contagious diseases or malaria infection may cause deterioration in parental and child health; which the latter induce a direct shift in child time from work to leisure. Thus inclusion of an array of shocks in our model should account for confounding effects of unobserved changes. If time-varying unobservables drive the relationship between parental illness and allocation of children's time, inclusion of such shocks into the model will result in a significant change the size and statistical significance of $\gamma_1$ and $\gamma_2$.

[26] An important point worth mentioning is that, the effect of illness of both parents may not be the same as the sum of effects of illness of the father and mother. Indeed, our data shows only three percent of the households in the sample experi9ncing parental illness reported that both parents were ill.

[27] Whether the exogeneity assumption is strong or weak depends on the estimation procedure. The assumption should be reasonable as far as all relevant time-varying observables are included in the model (Wooldridge, 1997).

### 5.2.2 Effects on Child Labour

The broader objective of this study is to identify welfare consequences of parental illness on children and to provide policy inputs. However, while very important in understanding how allocation of children's time responds to parental illness, the parameters in (11), $\gamma_1$ and $\gamma_2$, provide little information whether or not time adjustment responses are harmful to children's welfare. From welfare perspective, an increase in work hour does not necessarily imply that children are worse off. As discussed in section 4, children would be worse off if the increase in work hour is large enough to interfere with their education or harm their health and jeopardize their mental and physical development (ILO 1973; UN 1989). In other words, illness would have stronger welfare implication if it induces child labour.

It is customary to measure child labour status as a discrete choice variable (Baland & Robinson, 2000; Basu & Van, 1998; Beegle et al., 2006; Ranjan, 1999). Thus we fit a binary choice model to estimate effect on child labour of parental illness. To be consistent with our fixed effects estimation in (11), we fit a Correlated Random Effects (CRE) probit model to deal with unobserved heterogeneity.

The model has some interesting features. First, unlike the conventional random effects probit, the CRE model allows correlation between observable covariates and unobservable individual fixed effects and explicitly models the latter as a function of time average of time-varying observables. Second, as opposed to fixed effects models, it allows identification of parameters of key time constant variables such as gender and parental education. Lastly, unlike fixed effects logit, we can easily compute average partial effects of covariates (Mundlak, 1978; Wooldridge, 2011).

Suppose the unobserved fixed effects can be modelled as:

$$\eta_i = \delta + \bar{x}_{ij}\rho + \theta_i \tag{12}$$

where $\bar{x}_{ih}$ is the time average of time-varying observables; $\rho$ is a measure of possible correlations between $\bar{x}_{ij}$ and $\eta_i$; and $\theta_i$ is a time-invariant error term assumed to be uncorrelated to $\bar{x}_{ij}$.

Using (12) as proxy for $\eta_i$, the probability of participation in child labour can be determined as:

$$P\left(y_{ijt}=1\middle|w_{ijt},h_{it}^{m},h_{it}^{f},\bar{x}_{ij},\theta_i\right)=\Phi(\delta+\alpha_1 h_{it}^{m}+\alpha_2 h_{it}^{f}+w_{ijt}^{'}\beta+\bar{x}_{ij}\rho+\theta_i) \quad (13)$$

where $w_{ijt}$ is a vector of observable child, household and community characteristics; $\bar{x}_{ij}$ appears to account for systematic heterogeneities related to time-invariant unobservables.[28]

### 5.2.3 Additional Control Variables

In addition to parental health status, we include a vector of child, household and community characteristics into (11) and (13). We control for age and gender; the latter only in (13). We also include age squared to capture any nonlinearity in the effect on time allocation of age. Children may work fulltime and spend no time on schooling not because of resource constraints imposed by parental illness rather may be because they have already achieved the education level believed to be optimal or provided by schools in the locality. To account for such effects, therefore, we include highest grade achieved by children into the model.

We control for age and education level of parents. On the one hand, parents may experience depletion of health stocks as they get older (Grossman, 1972). On the other hand, irrespective of their health status, their earning may decline as they get older. As a result, they may need labour and income contribution from their children. Education also can simultaneously affect both parental health status and allocation of children's time. Better educated parents may earn higher income and afford to forgo returns from child work. Such parents are also more likely to have better access to health related information and engage in healthy lifestyles such as dietary choice and physical exercise (Leibowitz, 2004).

We also include indicators of households' demography: family size and gender of the household head. As discussed in the conceptual framework, parental altruism is a key factor affecting allocation of children's time. For example, parents may be more altruistic towards their own offspring than foster children. To rule out cases whereby time allocation decisions

[28] An interesting feature of the model is that the random effect probit can be nested in it. A test of a null-hypothesis $\rho = 0$ can be done using the usual Wald test and failure to reject the null reduces the model to a random effect probit.

would be motivated by parental callousness, we include dummy variables for the presence of the biological father and mother in the family. As noted by Basu (2006) balance of power between parents could be also important in making time allocation decision. Children, whose parents have equal bargaining power, may spend less time in work and more time in leisure activities. Following Ray and Basu (2002), we include the ratio of year schooling of the mother to the sum of years of schooling of the mother and the father as a measure of bargaining power of the mother

We also control for different components of household wealth.[29] We use a wealth index constituting three sub-indexes that measure quality of housing such as number of bed rooms per person and main material of walls, roof and floor; ownership of consumer durables such as radio, bicycle, automobile, sofa, chair and table; and households' access to services such as electricity, clean water and sanitation. In addition, since land and livestock are important components of household wealth in rural areas, we include farm size, measured in hectares, [30] and a dummy showing whether or not the household owns livestock.

Income and consumption expenditure are not included in the model since their effect on time allocation can be captured by parental illness. Indeed, if included, they may cause endogeneity as working children may contribute to household income and consumption. To capture for changes in household income and consumption not induced by illness, we control for an array of idiosyncratic shocks that may affect household's livelihood. We include dummies showing whether or not the household experienced events such as loss of job by the main breadwinners,[31] theft, forced eviction, death of livestock, crop failure and illness of other household members.

Lastly, we also control for a range of community characteristics. We include dummies showing whether or not: the community is urban, financial and healthcare institutions are available, and the community has ever experienced aggregate shocks such as drought and

[29]Wealth is built up over the life course of households through accumulated savings. Thus it can help us capture a range of unobservable effects on parental health and allocation of children's time (Strauss et al., 1993).

[30] Since parents having children may want to lease in more farm plots, we use only farm size owned by the household to avoid endogeneity. Land ownership is most likely to be exogenous to household characteristics because, in Ethiopia, land ownership belongs to the government and households cannot acquire land through purchase.

[31] Indeed, job loss could be attributed to illness episodes. In our data, 61 percent of households reported job loss also reported illness experience of at least one of the parents. To check for possible collinearity we run our empirical model with and without job loss. However, the effects of parental illness show no significant change.

flood. We include the interactions of community and year fixed effects to capture for unobserved effects arising from changes in local conditions.[32]

[32] Since the government in Ethiopia is a federal system overtime changes in implementation of macroeconomic policies can vary across regions. Thus we use regional dummies to account for community fixed effects

# 6. Results and Discussion

As discussed in section 5, we estimate fixed effects models for the child labour and time allocation data. In both cases, we apply robust standard errors. Results including a full set of explanatory variables are provided in Appendix II. We find that child characteristics such as age and highest grade achieved have significant effects on allocation of children's time. Age has decreasing effect on leisure time and increasing effect on work hours and participation in child labour. Children with higher grade achievement are less likely to participate in child labour and more likely to enjoy leisure time.

Parental characteristics are also found to have significant effect on time allocation outcomes. While time spent in leisure falls with years of education of the mother, it increases with years of education of the father. Conversely, time spent in work increases with education of the mother and falls with education of the father. However, we find no significant effect of parental education on child labour. Presence of biological parents is negatively associated with participation in child labour. Children who live with their biological parents spend more time in school and leisure activities than those who live with non-biological parents. Children in male-headed families spend fewer hours in leisure and more time in work than children in female-headed families.

## 6.1 Parental Illness and Time Allocation

In this subsection we discuss the estimates obtained with the Fixed Effects Poisson. Table 7 presents results estimated using the full sample of children. Results for the full set of variables are presented in Table 1A and 1B of Appendix II. The second and third columns, respectively of Table 7 show effects of parental illness on time spent in leisure and work. Leisure represents total time spent in play and school, whereas work represents total time spent in domestic chore and market work. As shown in the Table, time spent in leisure and work, respectively decreases by 7.2 percent and increases by 18.8 percent when the family experiences illness of the mother. On the other hand, illness of the father is associated with 3.2 percent decrease and 8.5 percent increase in time allocated to leisure and work, respectively.

Table 7 **Effect on time spent in leisure and work**

| Variables | Leisure | Work |
|---|---|---|
| mother ill | -0.074*** | 0.176*** |
| | (-0.012) | (-0.023) |
| father ill | -0.032* | 0.085** |
| | (-0.014) | (-0.025) |
| Obs. | 4538 | 4518 |

*Note:* * represents significance at 10%; ** at 5% and *** at 1%.
The Fixed Effects Poisson (FEP) estimation includes all explanatory variables presented in Table 5 and Table 6 as well as interactions of time and community fixed effects.

In terms of magnitude and statistical significance, effects on time allocation of illness of the mother seem to be stronger than effects of illness of the father. Based on the 'luxury axiom' of Basu and Van (1998) our finding suggests that illness of the mother causes more welfare loss than illness of the father. This would be the case if the mother is the main breadwinner in the family. However, in the Ethiopian context, it is the father who is mostly responsible for producing market goods and earning income, whereas the mother is often responsible for domestic chores and childcare activities (Haile & Haile, 2012).

Data in Table 6 of section 4 also shows that about 80 percent of the households in the sample are male-headed. This suggests that time allocation effects of the mother may stem from non-income effects of illness. Based on the 'substitution axiom' of Basu and Van (1998), the role of children as insurance goods depends on whether or not child labour is a substitute for adult labour. In this regard, the stronger effect on leisure and work time of illness of the mother suggests that the degree of substitutability is stronger in the case of the mother than the father. Our result is to some extent similar to what Diamond and Fayed (1998) find in Egypt. The authors find that while adult men and children are complements, adult women and children are substitutes in performing tasks.

### 6.1.1 Effects by Activity Type

Indeed, if there is gender specific role in the family, we would expect illness of the father to have stronger effect on time spent in market work and illness of the mother to have stronger effect on time spent in domestic chore. We take advantage of the availability of data at disaggregated level to examine how various components of leisure and work respond to parental illness. We disaggregate leisure into time spent in play and school; and work into

time spent in domestic chore and market work. Results obtained using data for the full sample of children are presented in Table 8.

Table 8 **Effect on time spent in different leisure and work activities**

| Variable | Play | School | Leisure | Domestic | Market | Work |
|---|---|---|---|---|---|---|
| mother ill | -0.098*** | -0.033 | -0.074*** | 0.299*** | -0.170* | 0.176*** |
| | (0.025) | (0.024) | (-0.012) | (0.025) | 0.071 | (0.023) |
| father ill | 0.045 | -0.092*** | -0.032* | 0.012 | 0.276*** | 0.085** |
| | (0.027) | (0.031) | (0.014) | (0.027) | (0.071) | (0.025) |
| Obs. | 4538 | 1908 | 4538 | 4514 | 2334 | 4518 |

*Note*: * represents significance at 10%;** at 5% and *** at 1%. Time spent in school includes time for school attendance and time use for studying and doing homework. In 2006, children in the young cohort were younger than 7 years, the official age for entry to primary school. As a result, only 27 percent of them were enrolled in school. Thus we exclude them from the schooling equation to control for structural causes of excess zeros.

We observe interesting differences between effects of illness of the mother and the father on allocation of children's time. Illness of the mother significantly increases time for domestic chore and decreases time for market work and play. The effect on domestic chore is much stronger than the effect on market work; 29.9 percent increase against only 17 percent decrease, respectively.[33] This implies that part of the increase in time spent in domestic chore is compensated by a decrease in time spent in play. Illness of illness mother seems to have no discernible effect on time for schooling.

If the mother was responsible to producing money income, her illness would decrease time for education and increase time for market work. Because loss of income from illness of the mother would undermine the households ability to finance education and children would spent fewer hours in school. However, the role of the mother seems to be limited to performing household chore and her illness may have no significant pecuniary effect in the family. Rather illness of the mother can cause shortage of labour for domestic chore. Thus children may be able to reconcile school and work. Should additional time is needed for domestic chore, children can shift time away from market work and play and still have enough time to spend in school.

On the contrary, illness of the father is found to have significant effect on time allocated to school and market work. When the family experiences illness of the father, time spent in

[33]The effect on market work is less precisely estimated due to inflated zeros

school decreases by 9.2 percent, whereas time spent in market work increases by 27.6 percent. This conform to the conventional wisdom that income loss to illness of the primary breadwinner entails shit child time away from school to work. This is because children would be required to supplement family income. Should education absorb a substantial share of children's time or the household's budget, children may need to drop out of school, suggesting that time spent in school would decrease. Indeed, public schools in Ethiopia do not charge tuition fee, thus, direct cost of schooling may not be significant. However, opportunity cost of time spent in school may still make education unaffordable for families with ill father (Skoufias, 1993).

### 6.1.2 Effects by Gender

Gender specific roles assumed by parents may also apply to children. Traditionally, girls and boys may be responsible for performing different activities. For instance, like their mothers, girls may be mainly responsible for domestic activities, whereas like their father boys could be responsible for activities outside the house. This implies that illness of the father and mother may not be equally important for boys and girls.

Table 9 shows effects of illness of the father and the mother on time spent in various activities for different groups of children. Results for full set of explanatory variables are presented in Table 1C to 1F of Appendix II. For boys, both illness of the mother and the father have decreasing and increasing effects on total time spent in leisure and work activities, respectively. However, while illness of the mother increases time spent in domestic work, illness of the father increases time spent in market work. Illness of the mother has no discernible effect on time spent in school, whereas it has significant negative effect on time spent in play. On the contrary, illness of the father significantly increases time spent in play and decreases time spent in school. For girls, on the other hand, only illness of the mother has significant effect on time allocation. When the mother is ill, girls spent more time on domestic chores and less time on leisure activities and market work.

Table 9 **Effects on time spent in leisure and work by sample group**

| Sample Group | Variable | Play | School | Leisure | Domestic | Market | Work |
|---|---|---|---|---|---|---|---|
| Boys | mother ill | -0.079** | -0.049 | -0.063*** | 0.263*** | -0.084 | 0.131*** |
| | | (0.035) | (0.045) | (0.018) | (0.042) | (0.081) | (0.035) |
| | father ill | 0.063* | -0.141*** | -0.055*** | 0.057 | 0.290*** | 0.140*** |
| | | (0.038) | (0.054) | (0.020) | (0.043) | (0.078) | (0.036) |
| Girls | mother ill | -0.117*** | -0.073* | -0.071*** | 0.313*** | -0.344** | 0.214*** |
| | | (0.035) | (0.043) | (0.015) | (0.029) | (0.141) | (0.030) |
| | father ill | 0.025 | 0.019 | -0.005 | -0.016 | 0.143 | 0.028 |
| | | (0.038) | (0.048) | (0.018) | (0.033) | (0.160) | (0.033) |
| Young | mother ill | -0.089*** | -0.036 | -0.080*** | 0.325*** | -0.158 | 0.211*** |
| | | ( 0.030) | (0.072) | (0.016) | (0.038) | (0.112) | (0.035) |
| | father ill | 0.026 | -0.048 | -0.031* | 0.066 | 0.532*** | 0.142*** |
| | | (0.033) | (0.076) | (0.018) | (0.040) | (0.116) | (0.036) |
| Old | mother ill | -0.124*** | -0.032 | -0.060*** | 0.267*** | -0.141 | 0.151*** |
| | | (0.040) | (0.025) | (0.017) | (0.032) | (0.090) | (0.031) |
| | father ill | 0.128*** | -0.092*** | 0.024 | -0.031 | 0.136* | 0.036 |
| | | (0.046) | (0.032) | (0.021) | (0.036) | (0.082) | (0.033) |

*Note:* * represents significance at 10%; ** at 5% and *** at 1%.

Our results are consistent with findings by previous studies. In her analysis of the intra-household time allocation decision of families in the late 19th century in America, Goldin (1979) finds strong substitution between daughters and mothers in areas of household production. Thus our result suggests that the family structure in Ethiopia is not different from the structure existed in American 200 years back. Skoufias (1993) also finds negative effect of increase in wage rate of the mother on girls' school attendance, suggesting that girls assume their mothers role in the house when the mother leaves for market work.

A closer look at the gender specific effects also reveals a more heterogeneous picture. While both girls and boys can substitute the mother in performing domestic chore, only boys can substitute the father to perform market work. This may be because participation in market work is either culturally inappropriate or unsafe for girls. In rural Ethiopia, for example, farms may be located far away from the house and sending girls to work on farms without accompanied by adult male may be considered unsafe. Thus their role could be limited to household chores. The data in Table 4 shows that about 45 percent of boys in the sample participate in market work and spend on average 2 hours in a day, whereas only 25 percent of

girls participate in market work and spend on average 40 minutes in a day. On the other hand the data on participation in domestic work shows that about 92 percent of boys in the sample perform some domestic activity and spend on average 2.5 hours in a day. Indeed, boys may not perform certain types of domestic chores such as cooking for cultural reason. However, increase in time for domestic work implies that they might have involved in other domestic activities such as washing clothes, cleaning the house and nursing the ill mother.

### 6.1.3 Effects by Age Cohort

We fit the FEP for sample disaggregated by age cohort. Results presented in the lower half of Table 9 show that, for both the young and old cohort, illness of the mother is associated with increase in time spent in domestic work and decrease in time spent in play. On the other hand, illness of the father has different time allocation effect for young and old cohorts. For younger children, illness of the father only affects time spent in market work. For older children, it increases time spent in market work and decreases time spent in school. Surprisingly, illness of the father is associated with increase in time spent in play. This implies that children can be idle after leaving school.

Although idleness is not a common phenomenon, drawing data from 6 countries,[34] Biggeri et al. (2003) find that some children neither work nor go to school. On the other hand, Bacolod and Ranjan (2008) argue that children cannot be idle except that their participation in domestic chore is overlooked or they are sick or they are in transition stage between school and work. In this regard, we explicitly model for time spent in domestic work and our estimation shows that time for domestic work does not respond to illness of the father. We have also accounted for health status of children in our time allocation models. Furthermore, given majority of children, 60 percent, reside in rural areas, transition between work and school may not take long time as children can easily switch to work on their families' farms. Thus our finding suggests that children may indeed be idle as households take children out of school to reduce spending on education neutralise financial risks of illness of the father.[35]

[34]The countries are Brazil, Cameroon, Guatemala, Nepal, Turkey and Yemen.
[35] In fact given that primary school is free in Ethiopia cuts in education spending may not provide substantial leverage financial risks of illness.

## 6.2 Parental Illness and Child Labour

In this subsection we discuss effects on child labour of parental illness. Results for the full set of explanatory variables are presented in Table 1H of Appendix II. While our preferred estimates are those obtained with Correlated Random Effects (CRE) Probit, for the sake of completeness and comparison, we also present estimates obtained using Linear Probability Model (LPM) and Random Effects (RE) Probit. The parameters presented in the Columns corresponding to the RE and CRE probit models are Average Partial Effects (APEs) and their respective robust standard errors.

Table 10 **Estimates obtained with alternative models**

| | RE_Probit | CRE_Probit | LPM |
|---|---|---|---|
| Variable | Child Labour | Child Labour | Child Labour |
| mother ill | 0.132*** | 0.096*** | 0.095*** |
| | (-0.014) | (-0.020) | (-0.021) |
| father ill | 0.034* | 0.020 | 0.013 |
| | (-0.017) | (-0.023) | (-0.023) |
| *rho* | 0.114 | 0.141 | 0.731 |
| | (-0.043) | (-0.043) | |
| Obs. | 4538 | 4538 | 4538 |

Note: * represents significance at 10%; ** at 5% and *** at 1%.
rho comes from corresponding coefficient estimates in each model. The RE probit and LPM include all the covariates listed in Table 5 and Table 6 of section 4. The CRE probit includes time averages of time-varying observables included in the RE probit. We perform both Likelihood Ratio (LR) and Wald tests to check if the RE probit is nested in the CRE Probit. With Chi2(23)=176.56 Prob>chi2=0.0000 and chi2( 23) = 162.22 Prob > chi2 = 0.0000, respectively the test results show rejection of the null hypothesis that the time averages are jointly zero; implying that the CRE probit is more appropriate than the RE probit.

Estimates obtained with the RE probit show that parental illness has significant effect on child labour. Once we account for child fixed effects, the average marginal effects become smaller in size and the statistical significance of child labour effect of illness of the father vanishes. The estimates with CRE-probit show that children in households experiencing illness of the mother are 9.6 percentage points more likely than those who live in households with healthy mother to participate in child labour. This is a large effect given that more than 50 percent of children in the sample participate in child labour. We obtain a very similar effect using the LPM.

Given that the father is traditionally considered as the main breadwinner in the family and data also show that about 80 percent of the households are male-headed, we expect illness of the father to lead loss of income and increase child labour. However, illness of the father is found to have no significant effect on child labour. On the contrary, illness of the mother, who is mainly responsible for household production, remains to have a significant effect on child labour. This seems to contradict to the conventional wisdom that child labour primarily results from poverty and income shocks (Basu & Van, 1998; Fallon & Tzannatos, 1998; Udry, 2006).

Another possible explanation for our result is that illness of the father might not have caused loss of income. We estimate economic risks associated with parental illness to fully understand the role of children as insurance goods. Although our survey does not contain information on household income, it provides information about real household expenditure, in 2006 Birr, on food and non-food items. Thus we can use household expenditure as proxy to income. Should illness of the father lead to a significant reduction in household income; household expenditure falls.[36]

We estimate the effect of illness of the mother and the father on both types of expenditures. Results are presented in column 4 and 5 of Table 1I in Appendix II. Estimation results show that food expenditure is not responsive to illness of the mother and the father, whereas expenditure on non-food items falls when the father experiences illness. This implies illness of the father can lead to loss of household income. Indeed, results presented in Table 8 also show that illness of the father increases time spent in market work. Therefore, deterioration in father's health might indeed have caused income loss. However, the loss may not be strong enough to compel households to resort to child labour.

With respect to illness of the mother, while not statically significant, the signs of the coefficients in Table 1I suggest that illness of the mother may result in lower food consumption and higher expenditure on non-food items. This implies that, although the mother is primarily responsible for household chore, deterioration in her health may have some pecuniary effects that can lead to high rate of child labour participation. Increase in treatment cost could be one possible effect through which illness of the mother affects child

[36] In fact, illness of the father may increase expenditure on medical care and keep total non-food expenditure from falling.

labour. For instance, Bratti and Mendola (2014), using data from Bosnia and Herzegovina, also find that illness of the mother increases employability of children and reduce their chance of school enrolment through increased medical expenditure.[37]

Given that only 1.25 percent of the population has access to insurance in Ethiopia (FMOH, 2014)[38], illness of the mother may result in catastrophic health expenditure. Indeed, the government has introduced fee waiver schemes in public hospitals and health centres to improve health care utilization of the poor (Purvis et al., 2011). However, out-of-pocket payment still accounts for the lion share of expenditure on health. For instance, during the time, in 2006 and 2009, the Young Live surveys were conducted, out-of-pocket spending accounted for 77.3 and 85.1 percent, respectively of total expenditure on health care. In 2014, the share was estimated to be 78.1 (World Bank, 2016).

We exclude domestic chore from our child labour definition and estimate the child labour model to check whether or not child labour effect of maternal illness is associated with some pecuniary effects. In other words, we define child labour as participation in market work to confirm if domestic chore is the only way through which illness of the mother affects child labour. Column (2) of Table 1I in Appendix II shows that illness of the mother has negative effect on participation in market work. Given the presumption that child labour is detrimental to working children's welfare, the result sends an important message that children become better off when the mother is ill.

Nevertheless, child labour decreases not because children become idle or work fewer hours when the mother is ill, rather they shift their time from one type of work to another. As shown in Table 8, when the mother is ill, time is shifted from market work to domestic work. Domestic work can have detrimental effect on child welfare as it may interfere with children's education (ILO, 2008). Indeed some domestic activities such as cooking can be hazardous to health as they may involve the use of fire and sharp cooking appliances. This implies that domestic work is indeed the most important way through which illness of the mother affects child welfare. Therefore, unless we account for time spent in domestic chore,

[37] However, direct comparison between our finding and theirs is problematic. First, there is huge difference in cultural and economic settings between our samples. Second, their sample constitutes people aged 15-24 years. Individuals aged 18 and older are adults, who most likely to make their own decision on labour supply and school enrolment.

[38] Indeed, the government is in the process of initiating health insurance schemes and a community based health insurance is under implementation as a pilot project since 2012 (Alebachew et al., 2014).

we would reach to a misleading conclusion that children would be better-off when the mother is ill.

The mismatch between income and child labour effects of parental illness implies that child labour participation may not be determined only by supply side conditions. Although parents are willing to use child labour as a strategy to parental illness, children may not be able to take on responsibilities of their parents; suggesting that degree of substitutability between children and adults is important. For instance, some activities performed by the father may be physically demanding or require skills that children lack. Thus children perform only light work that does not require adult supervision and huge amount of stamina. On the other hand, the strong effect on child labour of illness of the mother can be attributed to ease of substitution between children and the mother. Although an ill mother could be functionally disable do to things by herself, she may still be able to supervise children while performing activities around the house.

Table 11 **Estimates obtained from disaggregated data**

| Sample Group | Variable | Child Labour |
|---|---|---|
| Boys | mother ill | 0.050* |
| | | (-0.028) |
| | father ill | 0.072** |
| | | (-0.030) |
| Girls | mother ill | 0.132*** |
| | | (-0.029) |
| | father ill | -0.032 |
| | | (0.034) |
| Young | mother ill | 0.039*** |
| | | (0.015) |
| | father ill | -0.001 |
| | | (0.017) |
| Old | mother ill | 0.053*** |
| | | (0.013) |
| | father ill | 0.031 |
| | | (0.015) |

*Note:* * represents significance at 10%; ** at 5% and *** at 1%. The parameters represent average partial effects and their corresponding standard errors.

If degree of substitution between adults and children governs decisions on child labour, the effects of parental illness on child labour might vary with child gender. For example, labour

or income loss to illness of the father can be easily replaced by boys; whereas labour loss to illness of the mother can be easily replaced by girls. We fit the child labour model for disaggregated data by gender. Table 11 presents results obtained with CRE probit.

Our result shows that parental illness indeed has gender dimension. For instance, illness of the father is found to have significant effect on child labour participation of only boys. This implies that gender specific specializations might have made substitution of labour lost to illness of the father easier to boys than to girls. On the other hand, illness of the mother has positive effect on child labour both for girls and boys. However, the effect is stronger for girls than for boys. Girls in households which the mother experiences ill health are 13.2 percentage points more likely to be involved in child labour than girls in households with healthy mother. When the mother is ill, girls are 6 percentage points more likely than boys to participate in child labour.

Lastly, we estimate separately the effects on child labour of parental illness for the young and old cohort. As shown in the lower part of Table 11, only illness of the mother has significant and positive effect on child labour. The effects are very similar for both groups.

## 6.3 Robustness Check

### 6.3.1 Time Allocation Effects

It is worth mentioning that our fixed effects estimates in the previous section will not be consistent if we fail to account for time-varying unobservables that may affect parental health and correlate with allocation of children's time. Most likely such unobservable effects would be related to factors that change overtime and affect all household members. For example, both children and households may be equally exposed to health risks. Events that entail large income loss may also simultaneously affect children's time use and parental illness. Unobserved changes in households' ability to invest in children's education and parental health may also confound our estimation results. In this regard, membership status in social networks is considered an important proxy for capturing stock of social capital that play important role in time allocation and human capital investment decisions (Beegle et al., 2006; Kawachi & Berkman, 2001).

To account for confounding effects, therefore, we include in our original model a vector of dummies showing whether households are members in at least one of three social groups, namely *iddir, equub and debbo* and whether they ever experienced negative events such as crop-failure, death of livestock, illness of other household members, theft, job loss by the main breadwinners and forced eviction. Results presented in column 3, 6 and 9 of Table 1A and 1B in Appendix II show that there is no significant change both in magnitude and statistical significance of the coefficients associated with illness of the mother and the father.

Unobserved changes in community characteristics may also cause spurious correlation between parental illness and time allocation decisions. For instance, on the one hand, improved access to health services may result in lower fertility rate and improved maternal health. On the other hand, fewer younger siblings in the family may mean that older children do not have to spend several hours in taking care of their younger siblings. Fewer children in the family may also mean less competition for scarce resources to attend school. Availability of financial institutions in the community may also make borrowing easily accessible to households so that they may be able to borrow to invest both in their own health and their children's education. In addition, community level threats such as droughts and floods may affect local market conditions that correlate with both allocation of children's time and parental health.

To account for community level confounding effects, we include a vector of dummies that show availability of microfinance institutions and health care centres and communities' exposure to natural disasters such as droughts and floods. In addition, we include interaction terms between year and regional dummies to account for changes in policy and institutional qualities at regional level. As shown in column 4, 7 and 10 of Table 1A and 1B in Appendix II, coefficients of illness of the father and illness of the mother are not sensitive to the presence of the aforementioned community characteristics.

We also check whether time allocation effects of parental illness are sensitive to alternative estimation techniques. Taking into account that decision on time allocation across alternative activities can be made simultaneously, we estimate a multivariate fractional logit model for the pooled data. We take fraction of time allocated to play, school, domestic chores and market work as outcome variables. Results are presented in Table 1G. Consistent with the

results obtained with the FEP estimation, illness of the mother is associated with a fall in the proportion of time allocated to play and market work. Maternal illness is found to increase time spent in domestic chores. Likewise, illness of the father is associated with an increase in the proportion of time spent in market work. Proportion of time spent in play and school falls when the father experiences illness. Unlike our FEP estimation results, however, the multivariate fractional logit estimates shows that illness of the mother reduces proportion of time spent in school, whereas illness of the father increases proportion of time spent in domestic chores. This could be due to failure to account for unobserved heterogeneity in the multivariate fractional logit model, suggesting that our fixed effect estimation is a more plausible approach.

### 6.3.2 Child Labour Effects

In addition to the sensitivity analysis done through controlling for various household and community characteristics, we check robustness of our child labour estimates using alternative econometrics specifications. Results in Table 1H of Appendix II shows that illness the child labour effect of illness of the mother remains statistically significant. Furthermore, we disaggregate the sample by gender and age to verify if significance of illness of the mother can be maintained. Despite differences in magnitude, results in Table 11 also confirm that illness of the mother is associated with significant increase in child labour across different groups of children.

# 7. Conclusion

Health shocks are among the most unpredictable and costly sources of economic hardships in developing countries. When a family member is ill, households may be subject to catastrophic out-of-pocket payments for medical care. Disabling conditions from chronic illness can also entail loss of labour supply and income (Dercon et al., 2005; Mendola et al., 2007; Schultz & Tansel, 1997; Sparrow et al., 2014). In response, households use various coping strategies to smooth income and consumption. There is growing evidence that intra-household labour supply adjustment is one of the most widely used coping strategies. When the main breadwinner is ill, other members of the household increase labour supply (Gertler & Gruber, 2002; Wagstaff, 2007). However, little is known whether or not children are part of the adjustment strategy.

Using data from Young Lives survey conducted in Ethiopia and applying fixed effect estimation techniques, we examine effects of parental illness on allocation of children's time. For the full-sample, our finding shows that allocation of children's time between work and leisure significantly responds to parental illness. Children work more hours and spend fewer hours in leisure when their parents are ill. Disaggregating data into different components of work and leisure reveals a heterogeneous picture of the relationship between illness and time allocation. While illness of the father reduces time spent in school and increase time spent in market work, illness of the mother reduces time spent in play and increase time spent in domestic work. Children spend fewer hours in market work when the mother is ill.

Estimates obtained with disaggregating data across gender and age cohort show even a more heterogeneous picture. With respect to gender, illness of the mother has stronger time allocation effect for girls, whereas illness of the father has stronger effect for boys. Indeed, we find no significant effect of illness of the father on time use by girls. As a result, time allocation effect of parental illness seems to be consistent with the traditional male-female roles. Effects on time allocation of illness of the mother and the father remain significant also for both older and younger cohorts.

We also find that child labour increases with parental illness. Estimations obtained with the full-sample show that illness of the mother is associated with increase in her child's

probability of participation in child labour by 9.6 percentage points. However, illness of the father is found to have no discernible effect on child labour. Disaggregating the sample into boys and girls, shows that child labour effect of parental illness has gender dimension. With no effect for girls, illness of the father is associated with 7.2 percentage point increase in the probability of child labour participation of boys. On the contrary, illness of the mother has stronger child labour effect on girls. When the mother is ill, girls are 6 percentage points more likely than boys to be involved in child labour.

It is worth mentioning the potential limitations of this study. First, our time diary data refers to one week recall period, whereas reports on health shocks refer to three years recall period. Thus respondents might have recalled and reported only major health events that caused chronic disabling conditions and large labour supply adjustments. Indeed, we have checked if there is imperfect consumption smoothing due to parental illness. We find that food consumption is not responsive to illness of the mother and the father. This suggests there may not be systematic bias towards reporting chronic illness. Second, our estimation might have not fully picked on effects of negative health events experienced much earlier than the survey week.

Despite these limitations, our findings have important implications. Since child labour is associated with poverty, the focus is often estimating the nexus between income shocks and child labour using participation in market work as an outcome variable. However, the strong effect on child labour of illness of the mother, who is mainly responsible to performing domestic work, suggests that child labour may be caused by non-pecuniary sources, such as shortage of labour in household production. Excluding domestic chores from child labour definition, apart from understating the child labour statistics, overlooks gender dimensions of child labour. Therefore, future studies should include time spent in domestic work while defining child labour.

While largely gender specific, parental illness can undermine child welfare through increased participation in child labour. To reduce child labour and promote education, policies should aim at improving households' access to health care services, especially preventive cares. Indeed, the government of Ethiopia has been implementing a nationwide health extension program for more than a decade. However, still much more effort has to be made to improve the scope and quality of health services, especially in the area of maternal health (Workie &

Ramana, 2013). In addition, since illness is highly unpredictable by its nature and poor households may not have readily available cash to pay for treatment, their health may deteriorate to irreversible conditions in the meantime. Thus establishing financial schemes that provide emergency loans may help reduce the incidence of child labour associated to parental illness. The government should also put a lot of effort into scaling up the community based insurance scheme, a pilot program under implementation since 2012. Finally, institutional reforms improving labour market conditions and reducing transaction costs associated with hiring labour, particularly housemaids may help households easily substitute away from child labour.

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# Appendixes

**Appendix I:** Theoretical Model

$$U = \varphi u_1(x_1) + (1-\varphi)u_2(x_2) + b(s) \quad (1)$$

$$y_p = w_f t_f(h_f) + w_m t_m(h_m) \quad (2)$$

$$y_c = w_c * l \quad (3)$$

$$p_1 x_1 + p_2 x_2 + es = w_f t_f(h_f) + w_m t_m(h_m) + w_c l \quad (4)$$

$$t_c = s + l \quad (5)$$

$$L = \varphi u_1(x_1) + (1-\varphi)u_2(x_2) + b(s) + \lambda_1[w_f t_f(h_f) + w_m t_m(h_m) + w_c l - p_1 x_1 - p_2 x_2 - es] + \lambda_2[t - s - l] \quad (6)$$

$$\frac{\partial L}{\partial x_1} = \varphi \frac{\partial u_1(x_1)}{\partial x_1} - p_1\lambda_1 = 0 \quad (7)$$

$$\frac{\partial L}{\partial x_2} = (1-\varphi)\frac{\partial u_2(x_2)}{\partial x_2} - p_2\lambda_1 = 0 \quad (8)$$

$$\frac{\partial L}{\partial s} = \frac{\partial b(s)}{\partial s} - e\lambda_1 - \lambda_2 = 0 \quad (9)$$

$$\frac{\partial L}{\partial l} = w\lambda_1 - \lambda_2 = 0 \quad (10)$$

$$\frac{\partial L}{\partial \lambda_1} = w_f t_f(h_f) + w_m t_m(h_m) + w_c l - p_1 x_1 - p_2 x_2 - es \quad (11)$$

$$\frac{\partial L}{\partial \lambda_2} = t - s - l = 0 \quad (12)$$

From (7) and (9) :

$$b'(s) = \left(\frac{e+w_c}{p_1}\right)(\varphi)u_1'(x_1) \quad (13)$$

From (8) and (9):

$$b'(s) = \left(\frac{e+w}{p_2}\right)(1-\varphi)u_2'(x_2) \quad (14)$$

Substitute (11) for $x_2$ in (14):

$$b'(s) = \left(\frac{e+w_c}{p_2}\right)(1-\varphi)u_2'\left(\frac{w_f t_f(h_f) + w_m t_m(h_m) + w_c l - p_1 x_1 - p_2 x_2 - es}{p_2}\right) \quad (15)$$

We use (12), (13) and (15) as first order derivatives to identify the theoretical relationship between health and time allocation of children.

*A) Relationship between illness and time spent in school*

Take total differentiation of (13) with respect to $s$ and $x_1$:

$$b''(s)ds = \left(\frac{e+w_c}{p_1}\right)\varphi u_1''(x_1)dx_1$$

$$dx_1 = \left(\frac{p_1}{w_c+e}\right)\frac{b''(s)}{\varphi u_1''(x_1)}ds \quad (16)$$

Substitute (12) for $l$ in (15) and take total differentiation with respect to $s, h_f, h_f$ and $x_1$:

$$b''(s)ds = \left(\frac{e+w_c}{p_2^2}\right)(1-\varphi)u_2''(x_2)\begin{bmatrix} w_f t_f'(h_f)dh_f + w_m t_m'(h_f)dh_m - \\ (e+w_c)ds - p_1 dx_1 \end{bmatrix} \quad (17)$$

To establish a relationship between time spent in school and a change in health status of a parent, we need to assume only one of the parents experiences ill health. Suppose the mother experiences no change in health and substituting (16) for $dx_1$ in (17) gives:

$$\frac{ds}{dh_f} = \frac{(e+w_c)*\varphi u_1''(x_1)*(1-\varphi)u_2''(x_2)*w_f t_f'(h_f)}{b''(s)[p_1^2(1-\varphi)u_2''(x_2)+p_2^2\varphi u_1''(x_1)]+(e+w)^2\varphi(1-\varphi)u_1''(x_1)u_2''(x_2)} \quad (18)$$

Similarly, we can define the relationship between illness of the mother and time spent in school by setting $dh_f = 0$ in (17). The sign of the relationship should be similar to $\frac{ds}{dh_f}$.

*B) Relationship between illness and time spent in work*

Substitute (12) for $s$ in (13) and take total differentiation with respect to $l$ and $x_1$

$$-b''(s)dl = \left(\frac{e+w_c}{p_1}\right)\varphi u_1''(x_1)dx_1$$

$$dx_1 = -\left(\frac{p_1}{w_c+e}\right)\frac{b''(s)}{\varphi u_1''(x_1)}dl \quad (19)$$

Substitute (12) for $s$ in (15) and take total differentiation with respect to $l, h_f, h_m$ and $x_1$;

$$-b''(s)dl = \left(\frac{e+w_c}{p_2^2}\right)(1-\varphi)u_2''(x_2)\begin{bmatrix} w_f t_f'(h_f)dh_f + w_m t_m'(h_f)dh_m + \\ (e+w_c)dl - p_1 dx_1 \end{bmatrix} \quad (20)$$

Similarly, assuming that only father experiences change in health status and substituting (19) for $dx_1$ in (20) gives us:

$$\frac{dl}{dh_f} = \frac{(e+w_c)*\varphi u_1''(x_1)*(1-\varphi)u_2''(x_2)*w_f t_f'(h_f)}{-b''(s)[p_1^2(1-\varphi)u_2''(x_2)+p_2^2\varphi u_1''(x_1)]-(e+w)^2\varphi(1-\varphi)u_1''(x_1)u_2''(x_2)} \quad (21)$$

Similarly, we can define the relationship between illness of the mother and time spent in work by setting $dh_f = 0$ in (20). The sign of the relationship should be similar to $\frac{dl}{dh_f}$.

**Appendix II:** Additional explanatory variables

Table 1A **Effects on leisure activities**

| Variable | Play | | | School | | | Leisure | | |
|---|---|---|---|---|---|---|---|---|---|
| | Model-1 | Model-2 | Model-3 | Model-1 | Model-2 | Model-3 | Model-1 | Model-2 | Model-3 |
| mother ill | -0.102*** | -0.101*** | -0.098*** | -0.034 | -0.037 | -0.033 | -0.074*** | -0.073*** | -0.069*** |
| | (0.025) | (0.025) | (0.025) | (0.024) | (0.025) | (0.025) | (0.012) | (0.012) | (0.012) |
| father ill | 0.042 | 0.051* | 0.045 | -0.092*** | -0.091*** | -0.091*** | -0.032** | -0.030** | -0.030* |
| | (0.027) | (0.028) | (0.027) | (0.031) | (0.032) | (0.032) | (0.014) | (0.014) | (0.014) |
| highest grade | -0.023 | -0.024 | 0.019 | 0.041** | 0.041** | 0.039* | 0.032*** | 0.033*** | 0.036*** |
| | (0.017) | (0.017) | (0.017) | (0.021) | (0.021) | (0.021) | (0.007) | (0.007) | (0.008) |
| child age | -0.479*** | -0.478*** | 0.221* | 0.217 | 0.212 | 0.085 | -0.032*** | -0.032*** | 0.042 |
| | (0.017) | (0.017) | (0.133) | (0.205) | (0.205) | (0.261) | (0.007) | (0.007) | (0.064) |
| age2 | 0.019*** | 0.019*** | 0.017*** | -0.009 | -0.009 | -0.011 | 0.000 | 0.000 | 0.000 |
| | (0.001) | (0.001) | (0.001) | (0.008) | (0.008) | (0.008) | (0.000) | (0.000) | (0.000) |
| mother’s educ. | -0.036* | -0.035* | -0.040** | 0.002 | 0.003 | 0.004 | -0.015** | -0.015** | -0.014** |
| | (0.020) | (0.020) | (0.018) | (0.017) | (0.017) | (0.017) | (0.006) | (0.006) | (0.006) |
| biological mother | 0.013 | 0.013 | 0.027 | 0.132 | 0.124 | 0.115 | 0.109*** | 0.109*** | 0.104*** |
| | (0.048) | (0.048) | (0.045) | (0.042) | (0.042) | (0.042) | (0.020) | (0.020) | (0.020) |
| mother’s age | -0.005 | -0.005 | -0.001 | -0.001*** | -0.001*** | -0.001*** | -0.001 | -0.001 | 0.000 |
| | (0.005) | (0.005) | (0.004) | (0.005) | (0.005) | (0.005) | (0.002) | (0.002) | (0.002) |
| father’s educ. | 0.039** | 0.038** | 0.049*** | -0.016 | -0.017 | -0.015 | -0.004 | -0.005 | -0.004 |
| | (0.020) | (0.019) | (0.017) | (0.013) | (0.013) | (0.012) | (0.007) | (0.007) | (0.007) |
| biological father | 0.187*** | 0.186*** | 0.144*** | 0.271*** | 0.270*** | 0.273*** | 0.253*** | 0.251*** | 0.250*** |
| | (0.037) | (0.037) | (0.035) | (0.048) | (0.048) | (0.048) | (0.021) | (0.021) | (0.021) |
| father’s age | -0.008** | -0.008** | -0.007** | 0.001 | 0.001 | 0.001 | 0.000 | -0.001 | -0.001 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.001) | (0.001) | (0.001) |
| mother's power | 0.270 | 0.243 | 0.367 | -0.052 | -0.062 | -0.044 | 0.016 | 0.010 | 0.021 |
| | (0.292) | (0.289) | (0.247) | (0.224) | (0.225) | (0.225) | 0.091 | (0.091) | (0.091) |
| head sex | -0.130*** | -0.133*** | -0.097** | -0.135** | -0.137** | -0.139** | -0.110*** | -0.109*** | -0.103*** |
| | (0.048) | (0.048) | (0.046) | (0.057) | (0.058) | (0.058) | (0.023) | (0.023) | (0.023) |
| household size | -0.008 | -0.008 | -0.012 | -0.005 | -0.004 | -0.006 | -0.003 | -0.003 | -0.003 |
| | (0.010) | (0.010) | (0.010) | (0.009) | (0.009) | (0.009) | (0.004) | (0.004) | (0.004) |
| wealth index | -0.072 | -0.081 | 0.000 | 0.160 | 0.196* | 0.181 | 0.131** | 0.136** | 0.132** |
| | (0.136) | (0.136) | (0.131) | (0.111) | (0.111) | (0.112) | (0.054) | (0.054) | (0.055) |
| owns animal | 0.072* | 0.067* | 0.081** | 0.004 | 0.002 | 0.007 | 0.016 | 0.017 | 0.014 |
| | (0.039) | (0.039) | (0.038) | (0.034) | (0.034) | (0.034) | (0.015) | (0.015) | (0.015) |
| land size | 0.002 | 0.002 | 0.001 | -0.001*** | -0.001*** | -0.001*** | 0.000 | 0.000 | 0.000 |
| | (0.002) | (0.002) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| urban | 0.147* | 0.141* | 0.075 | -0.128 | -0.142 | -0.137 | 0.066* | 0.066* | 0.062 |
| | (0.081) | (0.080) | (0.078) | (0.083) | (0.087) | (0.087) | (0.038) | (0.037) | (0.038) |
| other members ill | | 0.010 | 0.004 | | 0.000 | 0.004 | | -0.002 | -0.003 |
| | | (0.024) | (0.023) | | (0.023) | (0.023) | | (0.010) | (0.011) |
| crop failures | | -0.065* | -0.027 | | -0.023 | -0.023 | | -0.021 | -0.019 |
| | | (0.026) | (0.026) | | (0.027) | (0.028) | | (0.013) | (0.013) |
| death of livestock | | 0.027 | 0.025 | | 0.000 | -0.002 | | 0.006 | 0.005 |
| | | (0.025) | (0.025) | | (0.026) | (0.026) | | (0.013) | (0.013) |
| theft | | 0.019 | 0.018 | | -0.002 | -0.008 | | -0.025 | -0.026* |
| | | (0.032) | (0.031) | | (0.028) | (0.028) | | (0.015) | (0.015) |
| job loss | | -0.056* | -0.059* | | 0.080*** | 0.082*** | | 0.014 | 0.018 |
| | | (0.033) | (0.031) | | (0.026) | (0.026) | | (0.013) | (0.013) |
| forced eviction | | 0.006 | 0.014 | | -0.043 | -0.053 | | 0.012 | 0.015 |
| | | (0.051) | (0.050) | | (0.049) | (0.050) | | (0.024) | (0.024) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| social group | | -0.002 | 0.027 | | 0.030 | 0.029 | | -0.014 | -0.013 |
| | | (0.053) | (0.051) | | (0.062) | (0.062) | | (0.024) | (0.024) |
| microfinance | | | -0.053*** | | | 0.017 | | | 0.001 |
| | | | (0.055) | | | (0.048) | | | (0.024) |
| drought | | | -0.109 | | | 0.038 | | | -0.004 |
| | | | (0.028) | | | (0.032) | | | (0.014) |
| flood | | | 0.022 | | | 0.001 | | | 0.020 |
| | | | (0.026) | | | (0.027) | | | (0.012) |
| health centre | | | -0.018 | | | 0.053 | | | 0.065*** |
| | | | (0.030) | | | (0.035) | | | (0.013) |
| time*region FE | no | no | yes | no | no | yes | | no | yes |
| Obs. | 4538 | 4538 | 4538 | 1908 | 1908 | 1908 | 4538 | 4538 | 4538 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1B **Effects on work activities**

| Variable | Domestic | | | Market | | | Work | | |
|---|---|---|---|---|---|---|---|---|---|
| | Model-1 | Model-2 | Model-3 | Model-1 | Model-2 | Model-3 | Model-1 | Model-2 | Model-3 |
| mother ill | 0.293*** | 0.303*** | 0.299*** | -0.160** | -0.178** | -0.170** | 0.176*** | 0.180*** | 0.176*** |
| | (0.026) | (0.026) | (0.025) | (0.069) | (0.071) | (0.071) | (0.023) | (0.024) | (0.023) |
| father ill | 0.007 | 0.020 | 0.012 | 0.305*** | 0.283*** | 0.276*** | 0.084*** | 0.088*** | 0.085*** |
| | (0.028) | (0.028) | (0.027) | (0.070) | (0.071) | (0.071) | (0.025) | (0.025) | (0.025) |
| highest grade | -0.001 | 0.001 | 0.024 | -0.109*** | -0.110*** | -0.098*** | -0.040*** | -0.039*** | -0.027*** |
| | (0.018) | (0.018) | (0.018) | (0.033) | (0.033) | (0.034) | (0.013) | (0.013) | (0.013) |
| child age | -0.007 | -0.003 | 0.333 | 0.501*** | 0.505*** | 0.122*** | 0.113*** | 0.116*** | 0.285*** |
| | (0.020) | (0.020) | (0.238) | (0.051) | (0.052) | (0.495) | (0.017) | (0.017) | (0.189) |
| age2 | 0.001 | 0.001 | 0.000 | -0.016*** | -0.016*** | -0.017*** | -0.002** | -0.002** | -0.003** |
| | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) |
| mother's educ. | 0.019 | 0.021 | 0.017 | 0.090 | 0.084 | 0.099 | 0.034* | 0.036* | 0.035* |
| | (0.025) | (0.024) | (0.023) | (0.094) | (0.092) | (0.088) | (0.020) | (0.020) | (0.020) |
| biological mother | -0.432*** | -0.429*** | -0.405*** | 0.404*** | 0.410*** | 0.429*** | -0.214*** | -0.210*** | -0.191*** |
| | (0.037) | (0.037) | (0.037) | (0.144) | (0.143) | (0.141) | (0.033) | (0.033) | (0.033) |
| mother's age | -0.005 | -0.004 | -0.003 | 0.005 | 0.004 | 0.005 | -0.002 | -0.002 | -0.001 |
| | (0.005) | (0.005) | (0.005) | (0.016) | (0.016) | (0.016) | (0.005) | (0.005) | (0.005) |
| father's educ. | -0.007 | -0.009 | 0.003 | -0.090 | -0.089 | -0.090 | -0.010 | -0.011 | -0.006 |
| | (0.020) | (0.019) | (0.018) | (0.072) | (0.071) | (0.064) | (0.018) | (0.018) | (0.017) |
| biological father | 0.203*** | 0.200*** | 0.164*** | -0.888*** | -0.881*** | -0.874*** | -0.352*** | -0.352*** | -0.374*** |
| | (0.038) | (0.038) | (0.036) | (0.067) | (0.068) | (0.069) | (0.029) | (0.029) | (0.028) |
| father's age | -0.002 | -0.002 | -0.002 | 0.022** | 0.021** | 0.021 | 0.002 | 0.002 | 0.001 |
| | (0.003) | (0.003) | (0.003) | (0.010) | (0.010) | (0.010) | (0.003) | (0.003) | (0.003) |
| mother's power | 0.184 | 0.158 | 0.233 | -1.185** | -1.142* | -1.167** | -0.144 | -0.149 | -0.119 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (0.267) | (0.265) | (0.252) | (0.600) | (0.596) | (0.560) | (0.207) | (0.208) | (0.208) |
| head sex | -0.057 | -0.067 | -0.049 | 0.460*** | 0.461*** | 0.477*** | 0.166*** | 0.161*** | 0.173*** |
| | (0.060) | (0.060) | (0.057) | (0.142) | (0.143) | (0.144) | (0.051) | (0.051) | (0.051) |
| household size | 0.002 | 0.004 | 0.001 | -0.033 | -0.036 | -0.038 | -0.003 | -0.003 | -0.005 |
| | (0.012) | (0.011) | (0.011) | (0.028) | (0.028) | (0.028) | (0.009) | (0.009) | (0.009) |
| wealth index | -0.207 | -0.205 | -0.050 | -0.417 | -0.468 | -0.603 | -0.301** | -0.317** | -0.235* |
| | (0.149) | (0.150) | (0.149) | (0.390) | (0.395) | (0.408) | (0.131) | (0.132) | (0.134) |
| owns animal | -0.057 | -0.058 | -0.033 | 0.303 | 0.299 | 0.315 | -0.017 | -0.020 | -0.002 |
| | (0.038) | (0.038) | (0.037) | (0.206) | (0.208) | (0.205) | (0.041) | (0.041) | (0.041) |
| land size | 0.005** | 0.005** | 0.005** | -0.001 | -0.001 | -0.001 | 0.002* | 0.002* | 0.002* |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| urban | -0.003 | -0.015 | -0.002 | 0.019 | 0.031 | -0.074 | -0.110 | -0.114 | -0.112 |
| | (0.083) | (0.083) | (0.086) | (0.330) | (0.326) | (0.323) | (0.089) | (0.089) | (0.092) |
| other members ill | | -0.045* | -0.049 | | 0.088 | 0.108 | | -0.007 | -0.010 |
| | | (0.026) | (0.027) | | (0.063) | (0.064) | | (0.023) | (0.023) |
| crop failures | | -0.046* | -0.008 | | 0.087 | 0.082 | | -0.003 | 0.020 |
| | | (0.027) | (0.026) | | (0.058) | (0.058) | | (0.023) | (0.022) |
| death of livestock | | -0.041 | -0.042* | | 0.005 | -0.001 | | -0.019 | -0.018 |
| | | (0.026) | (0.025) | | (0.060) | (0.059) | | (0.023) | (0.023) |
| theft | | 0.062* | 0.083** | | 0.032 | 0.014 | | 0.039 | 0.049* |
| | | (0.034) | (0.032) | | (0.076) | (0.078) | | (0.029) | (0.029) |
| job loss | | -0.015 | -0.023 | | -0.119 | -0.112 | | -0.053 | -0.060* |
| | | (0.038) | (0.038) | | (0.117) | (0.117) | | (0.036) | (0.036) |
| forced eviction | | -0.110** | -0.059 | | -0.028 | -0.006 | | -0.069 | -0.043 |
| | | (0.051) | (0.046) | | (0.149) | (0.148) | | (0.048) | (0.045) |
| social group | | -0.012 | -0.016 | | -0.049 | -0.022 | | -0.020 | -0.022 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | (0.050) | (0.046) | | (0.127) | (0.126) | | (0.044) | (0.042) |
| microfinance | | | -0.167*** | | | 0.263** | | | -0.028 |
| | | | (0.051) | | | (0.131) | | | (0.046) |
| drought | | | -0.107*** | | | 0.158* | | | -0.049* |
| | | | (0.030) | | | (0.080) | | | (0.026) |
| flood | | | -0.037 | | | 0.009 | | | -0.026 |
| | | | (0.027) | | | (0.076) | | | (0.024) |
| health centre | | | -0.224*** | | | -0.083 | | | -0.162*** |
| | | | (0.033) | | | (0.106) | | | (0.03) |
| time*region FE | | no | yes | no | no | yes | | no | yes |
| Obs. | 4514 | 4514 | 4514 | 2334 | 2334 | 2334 | 4518 | 4518 | 4518 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1C **Effects on time allocation (for boys)**

| Variables | Boys | | | | | |
|---|---|---|---|---|---|---|
| | Play | School | Leisure | Domestic | Market | Work |
| mother ill | -0.079** | -0.049 | -0.063*** | 0.263*** | -0.084 | 0.131*** |
| | (0.035) | (0.045) | (0.018) | (0.042) | (0.081) | (0.035) |
| father ill | 0.063* | -0.141*** | -0.055*** | 0.057 | 0.290*** | 0.140*** |
| | (0.038) | (0.054) | (0.020) | (0.043) | (0.078) | (0.036) |
| highest grade | -0.016 | -0.032 | 0.024** | 0.033 | -0.057 | -0.018 |
| | (0.023) | (0.030( | (0.011) | (0.027) | (0.034) | (0.017) |
| child age | 0.304 | -0.745*** | 0.112 | 0.261 | 0.451 | 0.299 |
| | (0.189) | (0.239) | (0.088) | (0.263) | (0.554) | (0.208) |
| age2 | 0.018*** | -0.027*** | 0.000 | 0.000 | -0.016*** | -0.003** |
| | (0.001) | (0.002) | (0.001) | (0.002) | (0.003) | (0.001) |
| mother's educ. | -0.055** | 0.062*** | -0.018** | 0.006 | 0.109 | 0.021 |
| | (0.022) | (0.022) | (0.009) | (0.028) | (0.092) | (0.022) |
| biological mother | 0.061 | 0.108 | 0.087** | -0.386*** | 0.123 | -0.160** |
| | (0.077) | (0.096) | (0.038) | (0.097) | (0.191) | (0.070) |
| mother's age | -0.007 | 0.003 | -0.003 | 0.006 | 0.020 | 0.011 |
| | (0.005) | (0.010) | (0.003) | (0.008) | (0.013) | (0.006) |
| father's educ. | 0.066*** | -0.062*** | 0.002 | 0.019 | -0.160** | -0.016* |
| | (0.021) | (0.021) | (0.009) | (0.029) | (0.078) | (0.021) |
| biological father | 0.156*** | 0.265*** | 0.291*** | 0.108** | -0.791*** | -0.427*** |
| | (0.043) | (0.066) | (0.028) | (0.051) | (0.077) | (0.036) |
| father's age | -0.004 | -0.004 | -0.003 | 0.001 | 0.016 | 0.007 |
| | (0.004) | (0.007) | (0.002) | (0.007) | (0.011) | (0.006) |
| mother's power | 0.519* | -0.629 | 0.143 | 0.336 | -1.159* | -0.158 |
| | (0.314) | (0.315) | (0.123) | (0.323) | (0.606) | (0.243) |
| head sex | -0.137** | -0.056 | -0.112*** | -0.074 | 0.409*** | 0.199** |
| | (0.067) | (0.109) | (0.039) | (0.099) | (0.155) | (0.079) |
| household size | -0.022* | 0.002 | -0.007 | -0.002 | 0.008 | -0.005 |
| | (0.013) | (0.017) | (0.005) | (0.017) | (0.03) | (0.013) |
| wealth index | -0.008 | 0.222 | 0.116 | -0.087 | -0.543 | -0.238 |
| | (0.178) | (0.236) | (0.082) | (0.235) | (0.439) | (0.191) |
| owns animal | 0.155*** | -0.136* | 0.023 | 0.039 | 0.104 | 0.008 |
| | (0.055) | (0.070) | (0.024) | (0.060) | (0.210) | (0.064) |
| land size | -0.001 | 0.000 | -0.001** | 0.004*** | -0.002 | 0.001 |
| | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) |
| urban | 0.213** | -0.027 | 0.072 | 0.000 | -0.096 | -0.098 |
| | (0.101) | (0.189) | (0.057) | (0.129) | (0.337) | (0.139) |
| other members ill | 0.003 | 0.029 | -0.001 | -0.060 | 0.106 | 0.005 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.033) | (0.042) | (0.015) | (0.042) | (0.073) | (0.033) |
| crop failures | -0.047 | -0.045 | -0.041** | -0.015 | 0.137** | 0.048* |
| | (0.034) | (0.046) | (0.018) | (0.039) | (0.063) | (0.029) |
| death of livestock | 0.048 | -0.005 | 0.013 | -0.040 | -0.027 | -0.037 |
| | (0.035) | (0.048) | (0.019) | (0.041) | (0.065) | (0.031) |
| theft | 0.009 | -0.078 | -0.022 | 0.051 | 0.039 | 0.019 |
| | (0.045) | (0.057) | (0.023) | (0.051) | (0.087) | (0.041) |
| job loss | -0.084* | 0.054 | 0.001 | 0.004 | -0.070 | -0.034 |
| | (0.044) | (0.058) | (0.019) | (0.059) | (0.128) | (0.050) |
| forced eviction | -0.073 | 0.007 | -0.020 | 0.005 | -0.029 | -0.008 |
| | (0.064) | (0.107) | (0.036) | (0.065) | (0.168) | (0.067) |
| social group | 0.011 | 0.092 | -0.001 | -0.049 | -0.034 | -0.084 |
| | (0.066) | (0.099) | (0.033) | (0.079) | (0.137) | (0.058) |
| microfinance | -0.051 | 0.264*** | 0.013 | -0.194** | -0.007 | -0.084 |
| | (0.077) | (0.094) | (0.035) | (0.084) | (0.152) | (0.066) |
| drought | -0.108*** | 0.145*** | 0.002 | -0.100** | 0.057 | -0.071* |
| | (0.040) | (0.051) | (0.019) | (0.044) | (0.092) | (0.037) |
| flood | 0.008 | 0.095* | 0.020 | -0.052 | -0.027 | -0.035 |
| | (0.036) | (0.051) | (0.018) | (0.043) | (0.087) | (0.036) |
| health centre | -0.064 | 0.097 | 0.030 | -0.207*** | 0.092 | -0.106** |
| | (0.043) | (0.062) | (0.019) | (0.054) | (0.133) | (0.046) |
| time*region FE | yes | yes | yes | yes | yes | yes |
| Obs. | 2408 | 2170 | 2408 | 2390 | 1490 | 2394 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1D **Effects on time allocation (for girls)**

| | Girls | | | | | |
|---|---|---|---|---|---|---|
| Variables | Play | School | Leisure | Domestic | Market | Work |
| mother ill | -0.117*** | -0.073* | -0.071*** | 0.313*** | -0.344** | 0.214*** |
| | (0.035) | (0.043) | (0.015) | (0.029) | (0.141) | (0.030) |
| father ill | 0.025 | 0.019 | -0.005 | -0.016 | 0.143 | 0.028 |
| | (0.038) | (0.048) | (0.018) | (0.033) | (0.160) | (0.033) |
| highest grade | 0.061** | -0.142*** | 0.047*** | -0.001 | -0.261*** | -0.041* |
| | (0.025) | (0.032) | (0.01) | (0.022) | (0.085) | (0.021) |
| child age | 0.207 | -0.313 | -0.032 | 0.353 | -1.408 | 0.288 |
| | (0.178) | (0.26) | (0.094) | (0.338) | (1.259) | (0.309) |
| age2 | 0.015*** | -0.023*** | 0.000 | -0.001 | -0.019*** | -0.003** |
| | (0.001) | (0.002) | (0.001) | (0.001) | (0.006) | (0.001) |
| mother's educ. | 0.000 | -0.005 | -0.001 | 0.045 | 0.177 | 0.055 |
| | (0.024) | (0.030) | (0.008) | (0.038) | (0.189) | (0.038) |
| biological mother | -0.006 | 0.145*** | 0.105*** | -0.359*** | 0.823*** | -0.177*** |
| | (0.054) | (0.054) | (0.023) | (0.039) | (0.223) | (0.037) |
| mother's age | 0.004 | 0.006 | 0.003 | -0.011* | -0.064 | -0.014** |
| | (0.007) | (0.008) | (0.003) | (0.006) | (0.046) | (0.006) |
| father’s educ. | 0.000 | -0.019 | -0.015 | -0.024 | -0.035 | -0.016 |
| | (0.025) | (0.026) | (0.010) | (0.027) | (0.131) | (0.033) |
| biological father | 0.164** | 0.111 | 0.180*** | 0.118** | -1.381*** | -0.295*** |
| | (0.064) | (0.083) | (0.032) | (0.050) | (0.212) | (0.047) |
| father's age | -0.008** | 0.009** | 0.001 | -0.001 | 0.050** | 0.001 |
| | (0.004) | (0.004) | (0.001) | (0.003) | (0.022) | (0.003) |
| mother's power | -0.139 | -0.227 | -0.173 | -0.104 | -1.592 | -0.347 |
| | (0.359) | (0.395) | (0.121) | (0.385) | (1.91) | (0.406) |
| head sex | -0.080 | -0.117 | -0.094*** | -0.003 | 0.682** | 0.134** |
| | (0.064) | (0.079) | (0.028) | (0.067) | (0.305) | (0.067) |
| household size | 0.004 | 0.005 | 0.005 | 0.001 | -0.146** | -0.014 |
| | (0.014) | (0.016) | (0.006) | (0.013) | (0.070) | (0.013) |
| wealth index | 0.017 | -0.057 | 0.141** | -0.024 | -1.404 | -0.212 |
| | (0.187) | (0.227) | (0.070) | (0.186) | (1.006) | (0.184) |
| owns animal | -0.013 | 0.018 | -0.001 | -0.074 | 1.044* | -0.013 |
| | (0.050) | (0.069) | (0.018) | (0.046) | (0.581) | (0.050) |
| land size | 0.003*** | -0.002** | 0.000 | 0.006 | -0.008 | 0.005 |
| | (0.001) | (0.001) | (0.000) | (0.004) | (0.011) | (0.005) |
| urban | -0.077 | 0.234 | 0.053 | -0.055 | -0.116 | -0.158 |
| | (0.109) | (0.143) | (0.048) | (0.113) | (0.979) | (0.119) |
| other members ill | 0.010 | 0.003 | -0.010 | -0.042 | 0.108 | -0.012 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.033) | (0.042) | (0.015) | (0.033) | (0.154) | (0.032) |
| crop failures | 0.012 | 0.023 | 0.013 | -0.004 | 0.048 | -0.014 |
| | (0.041) | (0.046) | (0.019) | (0.034) | (0.142) | (0.033) |
| death of livestock | -0.001 | 0.012 | -0.005 | -0.032 | 0.143 | 0.011 |
| | (0.037) | (0.044) | (0.017) | (0.031) | (0.151) | (0.031) |
| theft | 0.004 | -0.031 | -0.034* | 0.132*** | -0.235 | 0.098** |
| | (0.043) | (0.056) | (0.019) | (0.041) | (0.182) | (0.040) |
| job loss | -0.041 | 0.053 | 0.044** | -0.084* | -0.229 | -0.107** |
| | (0.044) | (0.050) | (0.018) | (0.048) | (0.287) | (0.051) |
| forced eviction | 0.113 | -0.112 | 0.060* | -0.131** | -0.047 | -0.115* |
| | (0.074) | (0.086) | (0.032) | (0.061) | (0.329) | (0.061) |
| social group | 0.033 | 0.002 | -0.024 | -0.004 | 0.146 | 0.019 |
| | (0.080) | (0.090) | (0.031) | (0.052) | (0.272) | (0.054) |
| microfinance | -0.046 | 0.307*** | -0.022 | -0.155** | 0.700** | 0.047 |
| | (0.076) | (0.078) | (0.030) | (0.062) | (0.295) | (0.062) |
| drought | -0.094** | 0.062 | -0.012 | -0.117*** | 0.508*** | -0.031 |
| | (0.039) | (0.049) | (0.019) | (0.039) | (0.194) | (0.038) |
| flood | 0.046 | 0.155*** | 0.016 | -0.034 | 0.141 | -0.016 |
| | (0.039) | (0.046) | (0.016) | (0.034) | (0.176) | (0.033) |
| health centre | 0.043 | 0.146** | 0.118*** | -0.266*** | -0.392** | -0.223*** |
| | (0.042) | (0.059) | (0.018) | (0.040) | (0.195) | (0.040) |
| time*region FE | yes | yes | yes | yes | yes | yes |
| Obs. | 2130 | 1940 | 2130 | 2124 | 842 | 2124 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1E **Effects on time allocation (young cohort)**

| Variable | Young Cohort | | | | | |
|---|---|---|---|---|---|---|
| | Play | School | Leisure | Domestic | Market | Work |
| mother ill | -0.089*** | -0.036 | -0.080*** | 0.325*** | -0.158 | 0.211*** |
| | (0.030) | (0.072) | (0.016) | (0.038) | (0.112) | (0.035) |
| father ill | 0.026 | -0.048 | -0.031* | 0.066 | 0.532*** | 0.142*** |
| | (0.033) | (0.076) | (0.018) | (0.040) | (0.116) | (0.036) |
| highest grade | 0.022 | -0.432*** | 0.037*** | 0.065* | -0.032 | -0.006 |
| | (0.026) | (0.050) | (0.011) | (0.034) | (0.114) | (0.031) |
| mother's educ. | -0.025 | 0.036 | -0.011 | 0.006 | 0.272** | 0.029 |
| | (0.023) | (0.031) | (0.007) | (0.036) | (0.131) | (0.030) |
| biological mother | -0.02 | 0.131 | 0.096*** | -0.344*** | 0.326 | -0.178*** |
| | (0.064) | (0.161) | (0.032) | (0.074) | (0.260) | (0.064) |
| mother's age | -0.013* | 0.008 | -0.008*** | -0.001 | 0.050 | 0.012 |
| | (0.007) | (0.011) | (0.003) | (0.011) | (0.036) | (0.009) |
| father's educ. | 0.045** | -0.099** | -0.018** | -0.026 | 0.010 | 0.014 |
| | (0.023) | (0.042) | (0.009) | (0.032) | (0.108) | (0.031) |
| biological father | 0.198*** | 0.054 | 0.314*** | 0.193*** | -1.215*** | -0.477*** |
| | (0.042) | (0.160) | (0.031) | (0.050) | (0.125) | (0.042) |
| father's age | -0.007* | 0.012* | 0.001 | -0.006 | 0.051*** | -0.001 |
| | (0.004) | (0.007) | (0.002) | (0.007) | (0.017) | (0.006) |
| mother's power | 0.291 | -0.818 | -0.061 | -0.088 | -1.191 | -0.138 |
| | (0.324) | (0.521) | (0.121) | (0.429) | (0.866) | (0.387) |
| head sex | -0.115* | -0.021 | -0.104*** | -0.159 | 0.298 | 0.080 |
| | (0.059) | (0.131) | (0.031) | (0.099) | (0.325) | (0.087) |
| household size | -0.019 | 0.033 | -0.005 | 0.003 | 0.014 | 0.001 |
| | (0.012) | (0.027) | (0.006) | (0.017) | (0.056) | (0.015) |
| wealth index | -0.184 | 0.468 | 0.062 | 0.188 | -0.463 | -0.055 |
| | (0.161) | (0.374) | (0.072) | (0.227) | (0.717) | (0.206) |
| owns animal | 0.062 | -0.210** | -0.008 | 0.039 | 1.009** | 0.037 |
| | (0.047) | (0.103) | (0.019) | (0.060) | (0.415) | (0.062) |
| land size | 0.003*** | 0.002** | 0.000 | 0.007* | -0.188 | 0.006 |
| | (0.000) | (0.001) | (0.000) | (0.004) | (0.128) | (0.004) |
| urban | 0.152* | 0.368 | 0.193*** | -0.168 | -0.648 | -0.385** |
| | (0.086) | (0.466) | (0.045) | (0.135) | (0.836) | (0.153) |
| other members ill | -0.001 | 0.011 | -0.009 | -0.061 | 0.140 | -0.015 |
| | (0.028) | (0.062) | (0.014) | (0.038) | (0.107) | (0.034) |
| crop failures | -0.043 | 0.023 | -0.024 | -0.050 | 0.218** | 0.011 |
| | (0.031) | (0.106) | (0.019) | (0.036) | (0.102) | (0.031) |
| death of livestock | 0.043 | -0.077 | 0.011 | -0.077** | -0.041 | -0.026 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.029) | (0.103) | (0.018) | (0.036) | (0.109) | (0.034) |
| theft | 0.004 | -0.155 | -0.050** | 0.121** | 0.020 | 0.074* |
| | (0.039) | (0.108) | (0.022) | (0.047) | (0.130) | (0.044) |
| job loss | -0.086** | 0.057 | -0.005 | -0.019 | -0.016 | -0.041 |
| | (0.037) | (0.075) | (0.018) | (0.057) | (0.226) | (0.053) |
| forced eviction | -0.022 | 0.027 | 0.045 | -0.068 | -0.272 | -0.068 |
| | (0.065) | (0.171) | (0.034) | (0.072) | (0.234) | (0.066) |
| social group | 0.024 | 0.093 | -0.035 | -0.015 | 0.118 | 0.007 |
| | (0.061) | (0.174) | (0.029) | (0.059) | (0.214) | (0.056) |
| microfinance | -0.018 | 1.163*** | 0.007 | -0.111 | 0.058 | -0.079 |
| | (0.069) | (0.220) | (0.035) | (0.081) | (0.277) | (0.069) |
| drought | -0.054* | 0.291*** | 0.010 | -0.144*** | 0.229* | -0.083* |
| | (0.032) | (0.108) | (0.018) | (0.038) | (0.123) | (0.035) |
| flood | 0.028 | 0.556*** | 0.027 | -0.052 | 0.033 | -0.035 |
| | (0.032) | (0.109) | (0.017) | (0.040) | (0.148) | (0.039) |
| health centre | -0.017 | 0.203* | 0.078*** | -0.289*** | 0.104 | -0.197*** |
| | (0.037) | (0.080) | (0.017) | (0.045) | (0.189) | (0.042) |
| time*region FE | yes | yes | yes | yes | yes | yes |
| Obs. | 2598 | 2202 | 2598 | 2578 | 1164 | 2578 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1F **Effects on time allocation (for old cohort)**

| | Old Cohort | | | | | |
|---|---|---|---|---|---|---|
| Variable | Play | School | Leisure | Domestic | Market | Work |
| mother ill | -0.124 | -0.032 | -0.060*** | 0.267*** | -0.141 | 0.151*** |
| | (0.040) | (0.025) | (0.017) | (0.032) | (0.090) | (0.031) |
| father ill | 0.128*** | -0.092*** | -0.024 | -0.031 | 0.136* | 0.036 |
| | (0.046) | (0.032) | (0.021) | (0.036) | (0.082) | (0.033) |
| highest grade | 0.030 | 0.039** | 0.036*** | 0.025 | -0.104*** | -0.026* |
| | (0.022) | (0.021) | (0.012) | (0.022) | (0.033) | (0.014) |
| mother's educ. | -0.047*** | 0.003 | -0.017 | 0.040 | 0.113 | 0.053** |
| | (0.027) | (0.017) | (0.011) | (0.026) | (0.095) | (0.025) |
| biological mother | 0.097 | 0.119*** | 0.114*** | -0.408*** | 0.628*** | -0.186*** |
| | (0.062) | (0.042) | (0.024) | (0.041) | (0.176) | (0.039) |
| mother's age | 0.012* | -0.001 | 0.003 | -0.001 | -0.001 | -0.003 |
| | (0.005) | (0.005) | (0.003) | (0.006) | (0.020) | (0.006) |
| father’s educ. | 0.047** | -0.014 | 0.009 | -0.003 | -0.142** | -0.026 |
| | (0.023) | (0.012) | (0.008) | (0.020) | (0.059) | (0.016) |
| biological father | -0.021 | 0.274*** | 0.178*** | 0.124** | -0.661*** | -0.282*** |
| | (0.059) | (0.048) | (0.027) | (0.050) | (0.074) | (0.036) |
| father's age | -0.011*** | 0.001 | -0.002 | 0.001 | 0.011 | 0.003 |
| | (0.003) | (0.003) | (0.002) | (0.003) | (0.012) | (0.004) |
| mother's power | 0.179 | -0.04 | 0.095 | 0.090 | -1.611*** | -0.298 |
| | (0.386) | (0.227) | (0.132) | (0.300) | (0.566) | (0.239) |
| head sex | -0.049 | -0.141** | -0.109*** | 0.042 | 0.487*** | 0.212*** |
| | (0.071) | (0.058) | (0.036) | (0.061) | (0.155) | (0.057) |
| household size | 0.007 | -0.005 | 0.000 | -0.007 | -0.032 | -0.010 |
| | (0.014) | (0.009) | (0.006) | (0.013) | (0.030) | (0.011) |
| wealth index | 0.569*** | 0.182 | 0.287*** | -0.324* | -0.376 | -0.439*** |
| | (0.199) | (0.112) | (0.082) | (0.184) | (0.494) | (0.167) |
| owns animal | 0.113*** | 0.005 | 0.039 | -0.089** | 0.141 | -0.022 |
| | (0.059) | (0.034) | (0.024) | (0.045) | (0.215) | (0.051) |
| land size | -0.001 | -0.001*** | -0.001** | 0.004** | 0.000 | 0.001 |
| | (0.001) | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) |
| urban | 0.019 | -0.140 | -0.098 | 0.239** | -0.048 | 0.094 |
| | (0.132) | (0.088) | (0.062) | (0.112) | (0.325) | (0.113) |
| other members ill | 0.042 | 0.004 | 0.009 | -0.036 | 0.076 | -0.013 |
| | (0.040) | (0.023) | (0.015) | (0.034) | (0.074) | (0.030) |
| crop failures | 0.009 | -0.025 | -0.016 | 0.069* | -0.039 | 0.032 |
| | (0.044) | (0.028) | (0.018) | (0.036) | (0.065) | (0.029) |
| death of livestock | -0.011 | -0.002 | -0.002 | 0.038 | -0.009 | 0.007 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.043) | (0.026) | (0.017) | (0.033) | (0.067) | (0.028) |
| theft | 0.057 | -0.007 | 0.007 | 0.025 | 0.019** | 0.010 |
| | (0.051) | (0.028) | (0.021) | (0.04) | (0.085) | (0.036) |
| job loss | 0.010 | 0.084*** | 0.060*** | -0.049 | -0.314 | -0.124*** |
| | (0.057) | (0.026) | (0.02) | (0.047) | (0.133) | (0.047) |
| forced eviction | 0.099 | -0.043 | -0.001 | -0.065 | 0.214 | -0.029 |
| | (0.065) | (0.049) | (0.036) | (0.059) | (0.194) | (0.066) |
| social group | -0.019 | 0.029 | 0.005 | -0.004 | -0.195* | -0.081 |
| | (0.090) | (0.062) | (0.037) | (0.069) | (0.146) | (0.060) |
| microfinance | -0.021 | 0.014 | 0.003 | -0.172*** | 0.259 | 0.007 |
| | (0.082) | (0.047) | (0.033) | (0.061) | (0.137) | (0.056) |
| drought | -0.142*** | 0.028 | -0.020 | -0.025 | 0.040 | 0.012 |
| | (0.047) | (0.030) | (0.019) | (0.034) | (0.083) | (0.031) |
| flood | 0.016 | 0.002 | 0.005 | -0.023 | -0.031 | -0.009 |
| | (0.042) | (0.027) | (0.017) | (0.033) | (0.085) | (0.029) |
| health centre | 0.040 | 0.055 | 0.054** | -0.109** | -0.256* | -0.094** |
| | (0.055) | (0.035) | (0.021) | (0.043) | (0.137) | (0.041) |
| time*region FE | yes | yes | yes | yes | yes | yes |
| Obs. | 1940 | 1908 | 1940 | 1936 | 1170 | 1940 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1G **Estimates of multivariate fractional logit model**

| Variables | Play | School | Domestic | Market |
|---|---|---|---|---|
| mother ill | -0.043*** | -0.029*** | 0.082*** | -0.009*** |
| | (0.006) | (0.007) | (0.004) | (0.003) |
| father ill | 0.016** | -0.056*** | 0.020*** | 0.020*** |
| | (0.007) | (0.008) | (0.005) | (0.003) |
| highest grade | -0.006*** | 0.013*** | -0.002 | -0.004*** |
| | (0.002) | (0.002) | (0.001) | (0.001) |
| child age | -0.202*** | 0.209*** | -0.022*** | 0.016*** |
| | (0.006) | (0.007) | (0.004) | (0.003) |
| age2 | 0.008*** | -0.009*** | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| child sex | 0.012** | 0.004 | -0.062*** | 0.046*** |
| | (0.006) | (0.007) | (0.004) | (0.003) |
| mother's educ. | -0.007*** | 0.007*** | 0.000 | -0.001 |
| | (0.002) | (0.002) | (0.001) | (0.001) |
| biological mother | 0.018** | 0.004 | -0.039*** | 0.016*** |
| | (0.009) | (0.010) | (0.006) | (0.003) |
| mother's age | 0.000 | 0.000 | -0.001*** | 0.000 |
| | (0.001) | (0.001) | (0.000) | (0.000) |
| father's educ. | 0.000 | 0.002 | -0.001 | -0.001 |
| | (0.001) | (0.002) | (0.001) | (0.001) |
| biological father | 0.027*** | 0.056*** | -0.005 | -0.079*** |
| | (0.009) | (0.011) | (0.005) | (0.005) |
| father's age | 0.000 | 0.001* | -0.001** | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| mother's power | 0.037* | -0.012 | -0.011 | -0.015* |
| | (0.020) | (0.022) | (0.012) | (0.008) |
| head sex | -0.015 | -0.043*** | 0.021*** | 0.037*** |
| | 0.011 | 0.013 | 0.006 | 0.003 |
| household size | 0.000 | -0.002 | 0.003*** | -0.001 |
| | (0.002) | (0.002) | (0.001) | (0.001) |
| wealth index | -0.071*** | 0.206*** | -0.091*** | -0.044*** |
| | (0.025) | (0.028) | (0.015) | (0.010) |
| owns animal | 0.004 | -0.066*** | 0.018*** | 0.045*** |
| | (0.008) | (0.009) | (0.005) | (0.004) |
| land size | 0.000 | 0.000 | -0.001* | 0.001* |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| urban | 0.022** | 0.032*** | -0.029*** | -0.025*** |
| | (0.010) | (0.011) | (0.006) | (0.005) |
| other members ill | 0.000 | 0.001 | -0.005 | 0.004 |
| | (0.007) | (0.008) | (0.004) | (0.003) |
| crop failures | -0.006 | 0.004 | -0.005 | 0.008*** |

| | | | | |
|---|---|---|---|---|
| | (0.007) | (0.008) | (0.004) | (0.002) |
| death of livestock | -0.004 | 0.002 | -0.002 | 0.003 |
| | (0.007) | (0.008) | (0.004) | (0.002) |
| theft | 0.013 | -0.042*** | 0.020*** | 0.009** |
| | (0.009) | (0.010) | (0.006) | (0.004) |
| job loss | -0.013 | 0.024** | -0.008 | -0.004 |
| | (0.009) | (0.011) | (0.006) | (0.004) |
| forced eviction | 0.000 | -0.009 | 0.000 | 0.009 |
| | (0.014) | (0.016) | (0.009) | (0.006) |
| social group | 0.024*** | -0.015** | 0.001 | -0.010*** |
| | (0.007) | (0.008) | (0.004) | (0.003) |
| microfinance | -0.017** | 0.015* | 0.008* | -0.006** |
| | (0.007) | (0.008) | (0.004) | (0.003) |
| drought | -0.008 | -0.025*** | 0.025*** | 0.008*** |
| | (0.006) | (0.007) | (0.004) | (0.003) |
| flood | -0.022*** | 0.031*** | -0.003 | -0.006** |
| | (0.007) | (0.008) | (0.004) | (0.003) |
| health centre | 0.030*** | 0.003 | -0.040*** | 0.007* |
| | (0.009) | (0.012) | (0.007) | (0.004) |
| year2 | -0.029*** | 0.034*** | -0.013*** | 0.008*** |
| | (0.006) | (0.007) | (0.004) | (0.003) |
| Obs. | 4538 | 4538 | 4538 | 4538 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1H **Effects on child labour (alternative econometric specifications)**

| Variable | Full Sample | | | | Boys | Girls | Young Cohort | Old Cohort |
|---|---|---|---|---|---|---|---|---|
| | RE_Probit | CRE_Probit | LPM | Logit | CRE_Probit | | | |
| mother ill | 0.132*** | 0.096*** | 0.095*** | 0.626*** | 0.050* | 0.132*** | 0.039*** | 0.053*** |
| | (0.014) | (0.020) | (0.021) | (0.156) | (0.028) | (0.029) | (0.015) | (0.013) |
| father ill | 0.034** | 0.020 | 0.013 | 0.074 | 0.072** | -0.032 | -0.001 | 0.013 |
| | (0.017) | (0.023) | (0.023) | (0.180) | (0.030) | (0.034) | (0.017) | (0.015) |
| highest grade | -0.016*** | -0.034*** | -0.034*** | -0.243** | -0.027 | -0.047** | -0.050*** | 0.002 |
| | (0.005) | (0.013) | (0.013) | (0.103) | (0.017) | (0.020) | (0.011) | (0.008) |
| child age | 0.204*** | 0.362*** | 0.343*** | 2.694** | 0.274* | 0.408* | | |
| | (0.012) | (0.128) | (0.119) | (1.054) | (0.147) | (0.211) | | |
| age2 | -0.009*** | -0.008*** | -0.008*** | -0.055*** | -0.009*** | -0.007*** | | |
| | (0.001) | (0.001) | (0.001) | (0.006) | (0.001) | (0.001) | | |
| child sex | 0.004 | 0.002 | | | | | 0.007 | -0.005 |
| | (0.013) | (0.013) | | | | | (0.009) | (0.009) |
| mother's educ. | 0.001 | 0.001 | 0.017 | 0.557*** | 0.004 | -0.002 | -0.001 | 0.002 |
| | (0.004) | (0.004) | (0.010) | (0.220) | (0.005) | (0.006 | (0.003) | (0.002) |
| biological mother | -0.038** | -0.149*** | -0.181*** | -1.925*** | -0.104** | -0.141*** | -0.041 | -0.076*** |
| | (0.019) | (0.033) | (0.032) | (0.383) | (0.052) | (0.043) | (0.027) | (0.019) |
| mother's age | -0.002* | -0.001 | 0.000 | -0.02 | 0.001 | -0.004 | 0.000 | -0.001 |
| | (0.001) | (0.004) | (0.003) | (0.037) | (0.004) | (0.005) | (0.003) | (0.002) |
| father's educ. | -0.004 | -0.003 | 0.007 | -0.091 | -0.005 | 0.001 | 0.000 | -0.001 |
| | (0.003) | (0.003) | (0.011) | (0.197) | (0.004) | (0.005) | (0.002) | (0.002) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| biological father | -0.133*** | -0.115*** | -0.093*** | -1.181*** | -0.121*** | -0.105* | -0.071*** | -0.050*** |
| | (0.019) | (0.029) | (0.026) | (0.293) | (0.034) | (0.055) | (0.021) | (0.019) |
| father's age | 0.000 | 0.002 | 0.001 | -0.006 | 0.006* | 0.000 | 0.001 | 0.002 |
| | (0.001) | (0.002) | (0.002) | (0.021) | (0.003) | (0.004) | (0.002) | (0.001) |
| mother's power | -0.059 | -0.051 | 0.124 | -2.13 | -0.066 | -0.023 | -0.011 | -0.042 |
| | (0.044) | (0.044) | (0.162) | (2.52) | (0.057) | (0.065) | (0.031) | (0.029) |
| head sex | 0.115*** | 0.053 | 0.053 | 0.225 | 0.006 | 0.102* | -0.019 | 0.072*** |
| | (0.022) | (0.039) | (0.041) | (0.357) | (0.048) | (0.058) | (0.032) | (0.023) |
| household size | 0.007** | 0.009 | 0.006 | 0.067 | 0.011 | -0.002 | 0.006 | 0.001 |
| | (0.004) | (0.008) | (0.008) | (0.064) | (0.010) | (0.013) | (0.006) | (0.005) |
| wealth index | -0.368*** | -0.321*** | -0.296*** | -1.954*** | -0.145 | -0.490*** | -0.144*** | -0.196*** |
| | (0.054) | (0.108) | (0.113) | (0.883) | (0.142) | (0.165) | (0.081) | (0.070) |
| owns animal | 0.190*** | -0.016 | -0.021 | -0.201 | 0.044 | -0.056 | -0.010 | -0.001 |
| | (0.019) | (0.027) | (0.031) | (0.239) | (0.036) | (0.042) | (0.021) | (0.018) |
| land size | 0.000 | 0.000 | -0.002*** | -0.023 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.003) | (0.004) | (0.001) | (0.051) | (0.007) | (0.005) | (0.002) | (0.002) |
| urban | -0.138*** | -0.068*** | -0.132* | -1.318*** | -0.089*** | -0.028 | -0.033*** | -0.027 |
| | (0.025) | (0.026) | (0.072) | (0.53) | (0.034) | (0.038) | (0.018) | (0.016) |
| other members ill | 0.004 | 0.013 | 0.014 | 0.063 | 0.047* | -0.006 | 0.002 | 0.008 |
| | (0.015) | (0.021) | (0.021) | (0.157) | (0.026) | (0.033) | (0.015) | (0.014) |
| crop failures | 0.006 | -0.009 | -0.009 | -0.144 | 0.000 | -0.03 | -0.005 | 0.004 |
| | (0.016) | (0.022) | (0.022) | (0.165) | (0.027) | (0.035) | (0.016) | (0.014) |
| death of livestock | 0.017 | 0.002 | 0.001 | -0.003 | 0.010 | -0.008 | 0.004 | 0.001 |
| | (0.016) | (0.022) | (0.023) | (0.161) | (0.028) | (0.034) | (0.016) | (0.015) |
| theft | 0.013 | -0.019 | -0.015 | -0.175 | -0.046 | 0.03 | -0.017 | -0.009 |
| | (0.02) | (0.028) | (0.028) | (0.207) | (0.037) | (0.044) | (0.021) | (0.018) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| job loss | 0.011 | -0.004 | 0.003 | 0.077 | 0.032 | -0.068 | 0.012 | -0.024 |
| | (0.021) | (0.029) | (0.029) | (0.217) | (0.038) | (0.043) | (0.021) | (0.020) |
| forced eviction | 0.022 | -0.038 | -0.032 | -0.885** | -0.017 | -0.077 | 0.003 | -0.028 |
| | (0.030) | (0.042) | (0.040) | (0.389) | (0.049) | (0.068) | (0.028) | (0.029) |
| social group | -0.042*** | -0.001 | -0.005 | 0.061 | -0.063 | 0.059 | -0.022 | 0.016 |
| | (0.015) | (0.041) | (0.040) | (0.355) | (0.051) | (0.060) | (0.028) | (0.028) |
| microfinance | -0.037** | -0.069*** | -0.054 | -0.379 | -0.109** | -0.011 | -0.061*** | -0.007 |
| | (0.017) | (0.031) | (0.034) | (0.262) | (0.040) | (0.048) | (0.023) | (0.019) |
| drought | 0.088*** | -0.015 | -0.007 | -0.063 | -0.022 | -0.004 | -0.028* | 0.029** |
| | (0.014) | (0.021) | (0.023) | (0.170) | (0.026) | (0.033) | (0.014) | (0.014) |
| flood | -0.017 | -0.016 | 0.007 | -0.048 | -0.030 | 0.005 | -0.026** | 0.004 |
| | (0.014) | (0.015) | (0.023) | (0.162) | (0.020) | (0.023) | (0.012) | (0.009) |
| health centre | -0.011 | -0.015 | 0.011 | 0.141 | 0.056** | -0.090*** | -0.024* | -0.005 |
| | (0.020) | (0.019) | (0.024) | (0.214) | (0.026) | (0.029) | (0.014) | (0.013) |
| year2 | -0.072*** | -0.432 | -0.520 | -4.427 | -0.287 | -0.462 | 0.116*** | -0.101 |
| | (0.014) | (0.267) | (0.347) | (3.036) | (0.407) | (0.376) | (0.014) | (0.023) |
| Cons. | | | -1.440 | | | | | |
| | | | (0.995) | | | | | |
| Obs. | 4538 | 4538 | 4538 | 1590 | 2408 | 2130 | 2598 | 1940 |
| rho | 0.114 | 0.141 | 0.731 | | | | | |
| | 0.043 | 0.042 | | | | | | |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%.

Table 1I **Effects on child labour, school enrolment and household expenditure**

| Variable | Child labour | School enrolment | Food Expenditure | Non-food Expenditure |
|---|---|---|---|---|
| mother ill | -0.043** | -0.034** | -0.025 | 0.025 |
| | (0.018) | (0.017) | (0.023) | (0.038) |
| father ill | 0.055** | -0.035** | -0.049 | -0.154*** |
| | (0.022) | (0.018) | (0.030) | (0.044) |
| highest grade | -0.024*** | 0.036*** | | |
| | (0.012) | (0.010) | | |
| child age | 0.119 | -0.104 | | |
| | (0.104) | (0.110) | | |
| age2 | -0.010*** | -0.012 | | |
| | (0.001) | (0.001) | | |
| child sex | 0.173*** | 0.002 | | |
| | (0.013) | (0.010) | | |
| mother's educ. | 0.000 | 0.005* | -0.023 | -0.010 |
| | (0.004) | (0.003) | (0.019) | (0.025) |
| biological mother | 0.125*** | 0.122*** | | |
| | (0.035) | (0.027) | | |
| mother's age | 0.002 | 0.004 | -0.003 | -0.002 |
| | (0.004) | (0.004) | (0.004) | (0.006) |
| father's educ. | -0.004 | 0.000 | 0.017 | -0.016 |
| | (0.003) | (0.002) | (0.019) | (0.027) |
| biological father | -0.181*** | 0.118 | | |
| | (0.024) | (0.020) | | |
| father's age | 0.003 | 0.003 | 0.005* | -0.003 |
| | (0.002) | (0.002) | (0.003) | (0.004) |
| mother's power | -0.075* | 0.026 | 0.225 | -0.153 |
| | (0.041) | (0.033) | (0.245) | (0.458) |
| head sex | 0.104*** | -0.025 | 0.005 | 0.021 |
| | (0.038) | (0.033) | (0.055) | (0.077) |
| household size | 0.001 | -0.009 | 0.047*** | 0.069*** |
| | (0.008) | (0.006) | (0.010) | (0.015) |
| wealth index | -0.151 | 0.191** | 0.367*** | 1.360*** |
| | (0.102) | (0.087) | (0.144) | (0.214) |
| owns animal | 0.093*** | -0.009 | 0.062* | 0.011 |
| | (0.031) | (0.023) | (0.033) | (0.063) |
| land size | 0.000 | 0.000 | 0.001 | -0.006*** |
| | (0.003) | (0.001) | (0.001) | (0.001) |
| urban | -0.047** | -0.032 | 0.169** | 0.418*** |

| | | | | |
|---|---|---|---|---|
| | (0.023) | (0.020) | (0.076) | (0.118) |
| other members ill | 0.026 | 0.002 | 0.051** | 0.040 |
| | (0.018) | (0.016) | (0.026) | (0.040) |
| crop failures | 0.004 | 0.028* | -0.009 | -0.088** |
| | (0.018) | (0.015) | (0.026) | (0.040) |
| death of livestock | 0.021 | 0.008 | -0.025 | 0.010 |
| | (0.018) | (0.016) | (0.028) | (0.038) |
| theft | -0.002 | -0.012 | 0.033 | 0.143*** |
| | (0.024) | (0.021) | (0.034) | (0.055) |
| job loss | -0.024 | 0.001 | -0.041 | -0.014 |
| | (0.028) | (0.022) | (0.036) | (0.046) |
| forced eviction | 0.036 | 0.029 | 0.079* | 0.156** |
| | (0.037) | (0.030) | (0.046) | (0.072) |
| social group | -0.012 | 0.003 | 0.035 | 0.049 |
| | (0.036) | (0.031) | (0.048) | (0.055) |
| microfinance | 0.038 | 0.058** | -0.095** | 0.038 |
| | (0.026) | (0.023) | (0.047) | (0.061) |
| drought | 0.057*** | 0.015 | -0.082*** | -0.098** |
| | (0.019) | (0.016) | (0.027) | (0.039) |
| flood | 0.013 | 0.028** | -0.040 | 0.075* |
| | (0.015) | (0.013) | (0.024) | (0.041) |
| health centre | 0.020 | 0.002 | 0.050*** | 0.102** |
| | (0.020) | (0.015) | (0.030) | (0.044) |
| year2 | 0.261 | 0.642 | | |
| | (0.311) | (0.167) | | |
| time*region FE | | | yes | yes |
| Obs. | 4538 | 4538 | 4538 | 4538 |

*Note*: * represents significance at 10%; ** at 5% and *** at 1%. Child labour and school enrolment estimates are obtained with CRE-probit, whereas estimates for household expenditure are obtained with FEP.