Channels of Impoverishment due to Ill-Health in Rural Ethiopia[†]

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Abstract

This paper uses three years of household level panel data and event history interviews conducted in Ethiopia to analyse the effect of a variety of ill-health measures on household economic outcomes. We begin by examining the immediate effects of ill-health on health expenditure and labor supply, subsequently, we examine household coping responses and finally we examine the effect on household income and consumption. We find substantial financial burden in terms of increased health expenditure and income losses. Households cope by resorting to intra-household labor substitution, hiring wage labour, borrowing and depleting assets. While households are able to maintain food consumption, non-food consumption is not fully protected against certain measures of ill-health. This effect is larger for households with the lowest ability to self-insure. Maintaining current consumption through borrowing and depletion of assets and savings is unlikely to be sustainable and displays the need for interventions that work towards reducing the financial consequences of ill-health.

Keywords: Health shocks, ill-health, consumption insurance, health expenditure, labor supply, poverty dynamics, Ethiopia

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1. Introduction

The bulk of the existing studies on the economic consequences of ill-health focus on consumption (for example Davies 2010, Gertler et al. 2009, Dercon et al. 2005, Asfaw and von Braun 2004, Townsend 1994, Foster 1994, Cochrane 1991). The mixed evidence on the ability of households to insure consumption against ill-health, warrants studies which examine the channels through which ill-health affects consumption and how households cope with the effects of ill-health. Identifying the channels through which ill-health influences consumption is instructive in order to understand the longer-term effects of ill-health and to determine the scope and welfare effects of public interventions. In a similar vein, Chetty and Looney (2006) argue that focusing on the effect of ill-health on consumption is not very informative without determining how households smooth consumption. This paper offers such an analysis.

We use three years of household level panel data gathered in rural Ethiopia and event history interviews conducted with households that have recently experienced an episode of ill-health, to analyse the effect of a variety of ill-health measures on household economic outcomes. We begin by examining the immediate effects of ill-health on health expenditure and labor supply, subsequently we examine household coping responses and finally we examine the effects of ill-health on household income and consumption. While there are other papers which have considered the effects of ill-health on outcomes other than consumption, most recently papers by Sparrow et al. (2013), Mohanan (2013) and Genoni (2012), this paper offers a relatively more comprehensive analysis which allows us to discern the

immediate effects, coping responses and the consequences of a variety of ill-health measures.[1]

In addition to examining a range of outcomes we employ four ill-health measures of varying severity. This is important as whether or not ill-health affects consumption or other measures of economic welfare depends on the severity of the measure being used. For instance, Gertler and Gruber (2002) find that minor illnesses (*change in head's illness and chronic symptoms*) are insured while less frequent and severe illnesses (*limitations in physical functioning*) are not. Other papers report similar findings.[2] The existing evidence on Ethiopia (Dercon et al. 2005; Asfaw and von Braun 2004) does not make a distinction in terms of the severity of illness and results are mixed. While Dercon et al. (2005) reject the hypothesis of full consumption insurance against the *'illness of a household member*', Asfaw and von

[1] Existing studies have looked at a subset of these outcome variables. For instance, Mohanan (2013) considered the effects of accidents on debt and consumption; Sparrow et al. (2013) and Bales (2013) consider the effects of ill-health on health expenditure, self-reported coping responses, income and consumption; Genoni (2012) traces the effects on assets, transfers, income and consumption; Islam and Maitra (2012) on assets, loans and consumption; Nguyet and Mangyo (2010) examine both labor supply and consumption; Wagstaff and Lindelow (2010) focus on health expenditure and consumption; Wagstaff (2007) on health expenditure, income and consumption; Lindelow and Wagstaff (2005) on labor supply, health expenditure and income; Gertler and Gruber (2002) on labor supply, health expenditure, income and consumption and Kochar (1995) on loans and income.

[2] For instance, based on data from the United States, Cochrane (1991) analyzed the effect of '*short and long spells of illness (work days lost)*' on consumption growth and found that the former is insured while the latter is not. In an early study on India, Townsend (1994) reported that the '*percentage of year that an adult male is sick*' has no effect on household consumption. More recently, using data from Bangladesh, Islam and Maitra (2012) also find that household consumption is fairly well insured against '*incidence of illness, number of days of sickness and death of the main income earner*'. In contrast, Gertler et al. (2009) in Indonesia and Wagstaff (2007) in Vietnam report that consumption is sensitive to '*limitations in physical functioning*', and '*death of a working member, incidence of long spells of hospitalization and sizable drop in BMI of the head*', respectively.

Braun (2004) find that food consumption is protected against the '*illness of the household head*' while non-food consumption is not insured.[3]

The results presented in this paper are particularly useful from a policy perspective as at the moment the Government of Ethiopia is considering a nation-wide roll-out of a pilot community based health insurance (CBHI) scheme which was introduced in 13 districts in mid-2011. To preview our results, we find that, ill-health leads to an increase in health expenditure and to income losses. The effect on income takes place despite intra-household labor substitution and hiring-in of labor. Labor productivity differences and the use of resources for financing health care appear to be responsible for the income losses. Households cope by depleting livestock and by borrowing. While households are able to protect food consumption, we reject full consumption insurance in the case of non-food consumption particularly for households with the lowest ability to self-insure. Our results suggest that health insurance schemes are likely to protect households against impoverishment by reducing their exposure to health expenditure and by reducing the need to borrow and resort to the sale of assets.

The rest of the paper is organized as follows. Section 2 outlines a framework which guides the subsequent analysis. Section 3 describes data and methods. Section 4 presents estimates while section 5 contains concluding observations.

2. Analytical framework

As depicted in Figure 1, the two immediate effects of ill-health are its effects on labour supply and on health expenditures. Depending on its severity, ill-health may

[3] Similar results are found in the case of rural Indonesia (Sparrow et al. 2013) and in Tanzania (De Weerdt and Dercon 2006). That is, imperfect smoothing in the case of non-food spending while food consumption is fully insured.

affect both labor productivity and labor supply. Whether this translates into a reduction in crop output (income) in the current context, where households are primarily engaged in self-employed agriculture, is not clear. First, as noted by Kochar (1995), it depends on whether illness occurs in the slack or peak seasons. Second, since the need for specialized skills may not be as high as compared to other occupations, there is a greater possibility for intra-household labor substitution. In addition, hiring in wage labor and/or inter-household labor substitution, for example, through local labor sharing arrangements may also help mitigate the labor supply consequences of ill-health, although hiring in labor does entail costs. Overall, the effect on income will depend on the effectiveness of a household's coping strategy, that is, whether it is possible to compensate for the entire reduction in labor supply and whether there are productivity differentials between the sick member and substituted labor.

Conditional on seeking medical care, the second source of financial risk is increased health expenditure. The implications of this for household income and consumption depend on how health care is financed. First, households may rely on savings to meet such costs. To the extent that the use of savings to finance medical care curtails the ability of households to invest or purchase agricultural inputs it may translate into reductions in crop output (income) and consumption. Second, households may sell livestock – the key household asset, and/or borrow in order to finance health care needs.[4] Such coping responses are likely to have deleterious consequences for future income and consumption, but they may allow households

[4] In his work on Ethiopia, Dercon (2004) notes that livestock is the most important marketable asset and accounts for more than 90% of the value of assets. The event-history interviews that we conducted revealed that selling livestock, especially smaller ruminants (sheep and goats) rather than larger animals is a common coping response.

to protect current consumption. There are other coping possibilities, such as remittances from friends and relatives, which may have limited consequences for future income and consumption.[5] Notwithstanding this possibility, the main point is that focusing only on consumption provides an incomplete picture of the consequences of ill-health.

As illustrated in Figure 1, we begin by examining the immediate effect of ill-health/health status of a household head on labor supply and health expenditure, this is followed by an assessment of the coping responses adopted by households.[6] Specifically, we consider the effects on intra-household labor substitution, livestock holdings and borrowing.[7] Finally, we provide an assessment of the effects of ill-health on income and consumption.

3. Data and Methods

a. Data

The study is based on three rounds of a panel household survey data collected in 16 rural districts (*Woredas*) located in four regions of Ethiopia (Tigray, Amhara, Oromiya, and SNNPR) which together account for about 86 percent of the country's population (Population Census Commission, 2008).[8] The surveys were conducted in

[5] While relying on family and friends for support is a potential coping strategy, in a related paper (Yilma et al. 2014) we find that only 5% of households who have experienced a health shock in the year preceding the survey relied on such support.

[6] We focus on the health status of the household head as it is likely that this individual is the main bread winner. Asfaw and von Braun's (2004) paper on Ethiopia also focuses on the health status of the household head. Other papers such as Nguyen and Mangyo (2010), Lindelow and Wagstaff (2005) and Gertler and Gruber (2002) also focus on the health status of the household head.

[7] In principle we should also examine the effect of ill-health on household savings and gifts from family and friends. Unfortunately, we don't have data on savings.

[8] The study is part of a larger project designed to investigate the effects of pilot community based health insurance (CBHI) scheme which was launched in mid-2011. Twelve of the districts included in the survey host the CBHI scheme while one district in each region serves as a control.

March-April 2011, 2012 and 2013. Within each district the surveys were canvassed in six randomly chosen *Kebeles* (peasant associations or villages). In each of the 96 *Kebeles*, 17 households were randomly surveyed, yielding a total of 1,632 households comprising 9,455 individuals. Of the original sample of households, 98% and 97% were re-surveyed in 2012 and 2013, respectively.

The survey contains information on a variety of individual and household socioeconomic attributes such as consumption expenditure, crop output, off-farm income, on-farm and off-farm labor supply, livestock holdings, household demographics, employment and household health conditions. The survey contains a detailed health module which asked respondents to provide, for each household member ($age \geq 6$), information on general health status (excellent, very good, good, poor, very poor), incidence of illnesses experienced in the two months preceding the survey, information on prolonged illnesses, that is, an individual has experienced symptoms for more than 30 days and information on the ability to carry out their activities of daily living (ADL). The ADL includes (i) stand up after sitting down ($age \geq 6$) (ii) sweep a floor ($age \geq 6$) (iii) walk for 5km or for an hour ($age \geq 10$) (iv) carry 20 litres of water for 20 meters ($age \geq 15$) and (v) hoe a field for three hours ($age \geq 15$). The responses are then coded as '*can do it easily (code= 1), with a little difficulty (code=2), with a lot of difficulty (code=3)* and *not at all (code=4)*'.

In order to acquire a greater understanding of the mechanisms depicted in Figure 1, in January-February 2013, event history interviews were conducted with purposively selected households who had also been interviewed for the household survey. From each of the four regions, a district with a relatively high burden of ill-health was selected, and within each of the four districts, households were sampled

based on the reported incidence and severity of ill-health that they had experienced. A total of 42 households were interviewed.[9]

b. Measures of ill-health

As discussed above, the survey contains information on four measures that may be used to capture the health status of a household head. The first of these, any illness experienced in the two months preceding the survey may perhaps be characterised as a short-term measure of health status which reflects less severe illnesses and with which it may be easier to cope. A second measure, which reflects longer spells of illness, whether illness symptoms have been persisting for 30 days or more, may have more serious labor supply consequences and require costlier medical treatment. A third measure which covers multiple dimensions is self-assessed health (SAH) status.

A key issue with the use of self-reported illness and the SAH measure is that they are likely to be affected by a household's cultural and socio-economic background (Islam and Maitra 2012; Schultz and Tansel 1997).[10] For instance, the definition of good health is likely to vary by wealth and educational status. In addition, for the same objective health condition, it is possible that the better-off or those who are more informed, report a higher incidence of illness (Sindelar and Thomas 1991). Although these are valid concerns, the panel structure of the data

[9] Interviews were conducted with the household head or the spouse when the head was not available. We included 12 households which had been slightly affected by a health shock and 30 households which had been moderately or strongly affected by a health shock in 2012. The initial idea was to sample about 16 households per region. However, in each of the regions after about seven to eight interviews it was found that there was not much variation in the responses (so called saturation), and hence the final sample was reduced.

[10] For formal sector employees there are concerns that individuals may report that they are ill in order to justify reduced labor supply (reporting bias for the sake of sick leave). This is unlikely in the current case where we are dealing mainly with a sample of self-employed workers.

allows us to control for household fixed effects which should mitigate concerns about the effect of wealth and educational status on self-reported illnesses.

Perhaps a more objective health status indicator which is found to be negatively related to income and education (Gertler and Gruber 2002; Schultz and Tansel 1997) is the ADL index. As discussed above, the index is based on self-rated abilities to carry out specific tasks and not on self-reported illness measures, which are more likely to be endogenous to some of the outcome variables (for instance, labor supply). Our computation of this index follows Gertler and Gruber (2002) and Gertler et al. (2009) and is based on the algorithm developed by Stewart et al. (1990),

$$ADL_i = \left(\frac{Tscore_i - Minimum\ score}{Maximum\ score - Minimum\ score} \right).$$

$Tscore_i$ is the sum of the scores on all the activities of daily living reported by individual i while the minimum and maximum score relate to the minimum and maximum $Tscore$ in the data. The index takes the value one if an individual cannot perform any of the five activities (or is the least able individual in the sample) and a value of zero if the individual can perform all activities easily (or is the most able in the sample).

Descriptive statistics for the four health measures are provided in Table 1. In 2011, about 20% of household heads reported that they had experienced an illness in the two months preceding the survey. In 2012 and 2013 the incidence of illnesses was lower at 13.5 and 15.3%, respectively. The incidence of prolonged, perhaps more severe illnesses, was lower, and depending on the year ranges between 5.4 to about 9%. The share of household heads reporting poor or very poor health status

ranges between 6 to 9%. Consistent with the low incidence of poor health status, the ADL index ranges between 0.051 and 0.080 which indicates that, on average, household heads are readily able to carry out most of the activities of daily living. Over time, based on all four measures, there are changes in health status, although poor self-assessed health status and the incidence of prolonged illnesses are relatively stable (about 11% of household heads report a change) as compared to recent illnesses (24%) and the ADL index (30%). The fluctuation in the ADL index is similar to findings reported in Gertler et al. (2009) and Gertler and Gruber (2002).

c. Outcome variables

We measure household expenditure on health care by aggregating costs incurred for outpatient and inpatient care. The variable includes expenditure on consultation, diagnostic tests, medicine and transportation. Information on outpatient care was reported for the two months preceding the survey while information on inpatient care was provided for the twelve months preceding the survey. We extrapolate the health care costs incurred for outpatient care and use annualized health expenditure as our outcome variable of interest.

The employment module of the survey records each household member's (aged six years and above) engagement in on-farm and off-farm activities in the four weeks preceding the survey.[11] The information includes the number of days worked and the average number of hours per day worked on both types of activities. The two variables that we use to capture labor supply are the total number of hours worked (both on and off-farm) in the four weeks preceding the survey by the household head and the rest of the members of the household.

[11] About 75% of households work exclusively on-farm.

Information on household holdings of different livestock (goats, sheep, calves, bulls, oxen), the main household asset used to cope with the financial consequences of ill-health, are recorded. We use the number of different types of livestock owned rather than their monetary values. While this measure is less susceptive to reporting mistakes, it clearly does not account for differences in the quality of livestock. It is possible that using the number of different livestock may lead to an underestimate of the effect of ill-health on livestock ownership if households replace livestock that has been sold by smaller and lower quality animals. The probability of borrowing and the monetary value of all outstanding loans at the time of the survey are used to measure indebtedness.

Our measure of household income consists of two elements – the value of crop output and off-farm income. The survey gathered information on household annual output of 33 different crops. We use information on the per unit sales price of each crop to calculate the value of crop production. If a household did not sell a particular crop then we use the median *woreda* price of that crop to value crop output.[12] Off-farm income is calculated by multiplying the number of days worked in the past month by remuneration per day.[13]

Our surveys collected information on the quantity and monetary value of 41 food items consumed in the week preceding the survey and expenditure on 34 non-food items in the past month or year. This information is used to compute monthly

[12] If information on sales price was not available for particular crop in a particular *woreda* we worked with the median sales price for that crop in the zone.

[13] Information on off-farm income is restricted to those who work as employees and excludes income from off-farm self-employment. Income earned from such activities was not gathered. This is likely to lead to an underestimate of total income for 93 households who (at baseline) reported that a household member was engaged in off-farm self-employment activities.

per adult equivalent food and non-food consumption expenditures (excluding health expenditures).[14]

Table 2 provides summary statistics of the outcome variables. All monetary values of consumption and income have on average increased. This is expected as inflationary pressure, everywhere in the country, has been a norm for the past few years. Average household health expenditure constitutes 2.7% (first round) and 1.6% (third round) of average annual non-medical household consumption expenditure.

d. Methods

The empirical model that we use to examine the various channels outlined in Figure 1 is similar to the specification used in a number of studies in this genre (Genoni 2012, Asfaw and von Braun 2004, Gertler and Gruber 2002) and is written as,

$$(1) \quad \Delta(Y_{iv}) = \alpha_0 + \alpha_1 T_t + \theta_v + \beta \Delta H_{iv} + \sum_j \lambda_j \Delta X_{ivj} + \varepsilon_{iv}.$$

As displayed in (1), for household i located in village v, we regress changes in an outcome variable of interest (ΔY_{iv}) on a time dummy (*T*), 96 village fixed effects (θ_v), changes in the health conditions of the household head (ΔH_{iv}), and changes in a vector of controls (ΔX_{ivj}) which includes household economic status (main occupation of the household head, asset index quintiles, membership in a productive safety net programme), demographics (age, sex and religion of the head and the age-sex composition of the household), human capital (educational status of the head), social capital (if the household has someone to rely on in times of difficulties), the incidence of shocks in the twelve months preceding the survey (economic,

[14] We use the adult equivalent measures suggested by Dercon and Krishnan (1998). The average family size is about 4.8 adults.

natural and crime-conflict related) and a random error term (ε_{iv}).[15] Our focus is on the coefficient, β.[16] We estimate several variants of (1) using different empirical methods, depending on the nature of the dependent variable, and provide robust standard errors which allow for clustering at the village level.

The use of a differenced specification allows us to identify the effect of ill-health on various outcomes after sweeping away the effect of time-invariant observed and unobserved variables. For instance, a household's unobserved health endowment is likely to be correlated with the ill-health measures and labor supply and might confound estimates of the effect of illness on labor supply. However, as long as such endowments are time-invariant, estimates based on (1) will not be affected.[17] The set of village fixed-effects controls for village-specific differences in, among other factors, susceptibility to covariate shocks. To control for time-varying household specific shocks we estimate (1) with the inclusion of a set of variables that captures the incidence of natural, economic and crime/conflict related shocks.

Despite relying on a differenced specification and the inclusion of various controls, there are additional empirical issues which warrant a discussion. For a number of the outcomes, for example, health expenditure or the value of

[15] The asset index is constructed on the basis of a principal components analysis and is based on 68 items including housing conditions, land size, consumer durables, farm equipment and livestock. For specifications where livestock is a dependent variable we exclude the asset index. The productive safety net program is a social protection program intended for food insecure households.

[16] Specifically in the case of consumption, theory predicts that either through self-insurance mechanisms (such as savings) or inter-household risk sharing arrangements (support from friends and relatives) or borrowing and selling assets, households will aim to insulate consumption from transitory shocks to household income. That is, the coefficient on the measure of ill-health should not be statistically different from zero. Although households may adopt various coping measures, each of which might be difficult to observe, the test of full insurance measures the overall contribution of all coping responses.

[17] Additionally, to the extent that the ill-health measures, and for that matter other variables, are measured with error, differencing the data will eliminate time-invariant measurement error.

outstanding loans, the outcome variables are truncated at zero and their distribution is skewed. One possibility is to work with logged values of the variables and we do so in the case of consumption where we log consumption before differencing. For a number of the other variables, due to zero values we work with levels. However, since the outcome variables are in first differences, skewness is minimized even without a log transformation.[18] Thus, similar to Gertler and Gruber (2002), the tables reported in the main body of the paper are based on using OLS or logit models with changes in log consumption and changes in levels of other outcomes as dependent variables.

However, to probe the sensitivity of our results to this choice we conducted a number of robustness checks. Specifically, we estimated equation (1) by adding 1 to the variables with zero outcomes and then taking logs and differencing the variables. Following Genoni (2012), since the quartic root is a good approximation to the log transformation for positive values, we also estimated (1) using changes in the quartic root of the various outcome variables. With regard to health expenditure, Buntin and Zaslavsky (2004) note that zero observations can be accommodated without difficulty by employing one part generalized linear models. To this end, we also estimated the effect of ill-health on health expenditure using a poisson fixed effects model.[19]

[18] Typically, for almost all the outcome variable, first differences are evenly distributed over negative and positive values around a zero mean.

[19] While we are more interested in health expenditure and not just the probability of incurring health expenditure we also estimated two part models considering a) probit for the probability of spending b) expected log health expenditure given spending using OLS c) expected health expenditure using a generalized linear model with log link and gamma distribution. Regardless of the model, as is discussed later in the text, we find that all four measures of ill-health are associated with increases in the probability of spending and the amount spent on health care.

Changes in the health measures used in (1) and a number of the outcome variables may be simultaneously determined. For instance, household-specific changes in income due to crime or conflict may also have adverse effects on health outcomes. Several remarks are in order. First, we explicitly control for the incidence of natural, economic and conflict/crime related shocks in (1). Second, we use several measures of ill-health and while the self-reported illness measures are more likely to be susceptible to feedback effects it is less likely that the ADL index is as prone to such feedback effects. For instance, concerted labor effort is more likely to translate into illness as compared to influencing the ability of individual to engage in various activities of daily living. Finally, as will be discussed later in the text, our findings that illness has a greater effect on consumption for families that are less likely to be able to self-insure is not consistent with feedback effects.

Specifically, with regard to the effect of ill-health on consumption, estimates based on (1) may be misleading if ill-health alters preference. To elaborate, the test of consumption insurance assumes that preferences are fixed. However, if ill-health leads to a change in consumption preferences then the factor that drives β in equation (1) may not be effect of ill-health on budget constraint but changes in preferences. In our empirical work we control for changes in demographic variables that may lead to a preference shift. Furthermore, we examine the effect of ill-health affecting a household head on household consumption. Considering that the average household size in our baseline data is almost six, it seems unlikely that the health of the head will drive changes in household consumption preferences. To assess potential preference shifts we use a test suggested by Gertler and Gruber (2002). We

examine how estimates of (1) vary by the ability of a household to self-insure.[20] If the effect of ill-health on consumption is due to changes in the budget constraint, then full consumption insurance will be less likely to hold as the ability to self-insure reduces. On the other hand if health induced preferences play a dominant role then the effect of ill-health on consumption should not be correlated with the ability to self-insure. Our measure of self-insurance ability is household ownership of livestock (sheep, goats, calves and bulls) in the first round of the survey. As discussed earlier, selling livestock, especially smaller ruminants is often used to finance health care and in the current context serves as our measure of the ability of a household to self-insure.[21]

A final concern is that the introduction of the community based health insurance scheme during the time period covered by the data may potentially confound estimates based on (1). While an evaluation of the scheme is beyond the scope of this paper and the variable is excluded from our baseline specification we do examine the sensitivity of our estimates to household uptake of the scheme.

4. Estimates

a. Effects on health expenditure and labor supply

Estimates of the effect of the four health measures on annual health expenditure are reported in column 1 of Table 3. All the measures show that experiencing an illness or deterioration in health status leads to a statistically significant increase in health

[20] While the idea is the same, the manner in which we operationalize the ability to self-insure is different from that used by Gertler and Gruber (2002).

[21] The event-history interviews revealed households tend to selling sheep and goats rather than larger animals. Of the 1599 households in the second round, 26% did not have any of these animals (buffer stock livestock) while the rest have at least one.

expenditure. For instance, households experiencing an illness in the two months preceding the survey are likely to experience an 874 Birr increase in annual household health expenditure while those who experience prolonged illness may expect to spend about 1,100 Birr on health care. These figures amount to between 4.1 and 5.3% of annual household consumption in 2012.[22] A change in the household head's health status to poor/very poor is associated with an expenditure increase of about 793 Birr a year while a deterioration in the ADL index of 0.2, which is a movement from being able to easily do all the activities included in the index to an inability to execute one of them, is associated with additional expenditures of about 334 Birr a year.[23]

Column 2 of Table 3 provides estimates of the effect of the various health measures on the labor supply of the household head while columns 3 and 4 contain labor supply estimates for other household members and the household as a whole, respectively. Deteriorations in self-assessed health status and in the ADL index are associated with reductions in labor supply of between 12 and 17 hours per month (13 to 19% of average household head labor supply in 2012). The two illness measures do not translate into statistically discernible effects on the labor supply of the household head. It is of course possible that the household head continues to supply the same amount of labor but are not as productive.

b. Coping Responses

The decline in the labor supply of the household head is matched by an increase in the labor supply of other members of the household. This applies for all the health

[22] In 2012, on average, annual household consumption was Birr 21,139.

[23] The mean change in the ADL index among those whose physical functioning declines is 0.22.

measures, although the effect is precisely estimated only in the case of recent illnesses. The overall outcome of this process of adjustment is that at the level of the household an illness episode or deterioration in health status does not translate into a reduction in labour supply. In the case of three of the four illness measures, the increase in labor supply provided by other household members is larger than the reductions in labor supply. The life-history interviews also provided evidence of intra-household labor substitution. For instance,

"I mostly feel sick partly due to old age but my children are healthy. In this month, I went to a private clinic in Woreta [nearest town] due to a worm in my foot... It took about 15 days till I completed the medication and I was not working but my children did the work well. All of them are grown-ups and I have educated them. [Male respondent, Woji Arbamba Kebele of Amhara region, Interview conducted on 31st January 2013]"

While households are able to and perhaps have to (over) compensate for health-induced reductions in the labor supply of the household head, due to differences in productivity and/or the need to raise resources to finance health care needs there still may be negative consequences.[24] In addition to loss of income such consequences include loss of leisure time and if children pick up the slack it may come at the cost of school attendance. The life-history interviews show that the choice can be difficult especially if households need to rely on school-going children,

"My husband had something in his leg over a weekend… In total he was sick for over two weeks and did not do anything. He wanted our son to miss school and work on the field but my son refused as it was an exam time. I supported him because his attendance at school for the whole year would mean nothing if he doesn't sit for an exam. We then left the farm unattended. There was some crop output eaten by livestock during that time. The animals belonged to our relatives and we couldn't sue them. [Female respondent, Woji Arbamba Kebele of Amhara region, Interview conducted on 1st February 2013]"

[24] In Indonesia, Genoni (2012) also finds suggestive evidence for intra-household labor substitution.

We are not able to identify, at least statistically, the effects of ill-health on the use of wage labor as a coping response, however, the event history interviews reveal that households do use this option. As mentioned by one of the respondents,

> "Recently I had typhoid… Because we may lose output/ income when we fall ill, I employed labor for 500 birr to transport my harvest. I wouldn't have spent this much if I was not ill. There is no one to do the work at home as my husband is in a seasonal migration and my children are too young. [Female respondent, Kebabi Kebele of Tigray region, Interview conducted on 22 January 2013"

Other coping responses include borrowing and the sale of assets. Estimates of equation (1) for the probability of borrowing and the amount of the loan are provided in Table 4, columns 1 and 2 while the remaining columns pertain to the effects of ill-health on household livestock holdings. All measures of ill-health lead to an increase in the probability of having an outstanding loan. Depending on the health measure, the probability of borrowing is 1.7 to 2.6 times higher if a household head has experienced a negative health change. In terms of the amount of the loan, 3 of the 4 health measures are associated with increases in the amount of the loan. On average (0.22 points on the ADL index), for a household head experiencing a deterioration in physical functioning, loan amounts may be expected to increase by 93 Birr. Illnesses and unfavourable changes in SAH are associated with increases in borrowing of 277 and 289 Birr, respectively. Prolonged illnesses also lead to an increase in the loan amount but the coefficient is statistically insignificant. To place this effect in perspective, consider that the increases in borrowing associated with changes in the three health measures (which are statistically significant) amount to

between 25 and 36% of the increase in health expenditure induced by these measures.[25]

Consistent with the comments distilled from the event history interviews we find that households tend to sell smaller ruminants in response to ill-health. As shown in Table 4, a worsening of the SAH status of the household head and a decline in the ADL index are both associated with declines in household holdings of sheep. The estimates imply that for every ten households that experience a decline in SAH status, about 4 of them sell a sheep to finance health care needs. In the case of the ADL index, for every 10 household heads who experience the average deterioration in the sample (0.22) about 1 will sell livestock (sheep). There is no effect on household holdings of bulls and calves while change in ADL has some negative effect on ox holding. As discussed earlier, focusing only on the number of animals may not provide a complete picture as smaller and lower quality sheep/goats may have replaced household livestock holdings.

c. Effect on income and consumption

The analysis so far shows that the increase in health expenditure and the decline in the labor supply of the head of the household due to ill-health are compensated through increases in intra-household labor substitution, borrowing – which covers about 25-36% of health care costs and sales of small ruminants. Analysis reported in our earlier paper (Yilma et al. 2014) shows that financial support from family and friends is very limited and in addition to sales of assets and borrowing, households rely on savings to meet their health care needs.

[25] These percentages are based on estimates reported in Tables 3 and 4. In the case of SAH status, ill-health increases borrowing by 289 Birr and health expenditure by 793 Birr. For illness the corresponding figures are 277 and 874 and in the case of ADL they are 93 and 367 (at the average change in ADL).

Estimates reported in Table 3, columns 5 and 6 display a clear negative effect of all four measures of ill-health on crop output and total income. The estimates for crop output are statistically significant and large while those for total income are also large but not very precise. In terms of magnitude, the decline in annual household income due to a decline in the self-reported health status of the household amounts to about 10% of annual household income in 2012. For the two illness measures the effect lies between 10 and 19% of annual household income. In contrast to the effects on crop output there is no statistically significant effect of ill-health on total income. It is tempting to interpret this as evidence of household ability to compensate for losses in crop output by resorting to off-farm income-generating activities. However, this is perhaps not entirely correct as in the case of two of the four measures the point estimates indicate a larger decline in total income, although not statistically significant.

The decline in crop output despite no evidence of a reduction in household labor supply suggests that differences in labor productivity could be responsible for the decline. However, the event history interviews tend to suggest that the decline is driven by the diversion of household savings to finance health care needs as opposed to being used to buy agricultural inputs. For instance, consider,

"My wife is sick of modern illness, TB. She is recurrently sick and goes to health facilities quite often. I spent around 5000 birr. Her illness has affected our harvest. Because of health expenditure, I couldn't buy inputs of production (high yield seeds and fertilizer) on time and hence, reduced my output. [Male respondent, Oumbulo Tenkaka Kebele of SNNPR, Interview conducted on 11th February 2013]"

"My daughter had a stomach complaint for more than a week. I took her to a traditional healer but she couldn't get better. Then, I took her to a health center... I spent 300 birr for that. Due to her illness, I didn't work on my vegetable garden. As I used the money I put aside for seeds, I ran out of cash to buy the seeds to plant my vegetables. Although, after sometime, I worked off-farm (dig-out sand and sell) and

planted vegetables, I do not expect as much output as I planted it late. [Male respondent, Jara Damuwa Kebele of SNNPR, Interview conducted on 15th of February 2013]"

Finally, following Figure 1, we examine the effect of ill-health on consumption, both for the full sample and for sub-groups based on self-insuring ability (own livestock or not). Focusing on the full sample, the estimates reported in Table 5 show that, regardless of the ill-health measure, there is no effect on total consumption. Indeed, in the case of the ADL index there is a positive although statistically insignificant effect while for the other measures the coefficients are essentially zero.[26] Food consumption also displays a similar pattern. The estimates for non-food consumption are clearly more sensitive to ill-health and in the case of prolonged illnesses the estimates indicate an 8% reduction in non-food consumption. For other measures non-food consumption remains unaffected. The finding that non-food consumption is more sensitive to ill-health than food consumption is similar to results for Ethiopia reported in Asfaw and von Braun (2004) and Sparrow et al. (2013) for Indonesia.

Conditioning on self-insurance ability we find that across all health measures, those with a lower ability to self-insure experience a negative although statistically insignificant effect on total consumption and food consumption. It is only in the case of non-food consumption that such households experience large negative effects. Prolonged illness is associated with a reduction of 15% while the corresponding figure is 26% in the case of deterioration in SAH. Consumption for those with a

[26] Gertler et al. (2009) and Gertler and Gruber (2002) reject the hypothesis of full consumption insurance against limitations in physical functioning. Using data from Indonesia, Genoni (2012) finds that neither consumption nor assets are responsive to limitations in physical functioning. In the current case, although there is no effect on consumption, we do find an increase in indebtedness and depletion of assets induced by limitations in physical functioning.

greater ability to self-insure remains unaffected. This heterogeneity supports the argument that the effects of ill-health on consumption are driven by tighter budget constraints as opposed to preference shifts. Additionally, the different patterns suggest that it is ill-health induced reductions in income and labor supply that influence consumption and not the reverse. The effect heterogeneity results presented here are similar to those found in Indonesia by Sparrow et al. (2013), Gertler et al. (2009) and Gertler and Gruber (2002).

5. Concluding remarks

This paper used three waves of panel data and event history interviews conducted in rural Ethiopia to examine i) the channels of impoverishment due to ill-health ii) the coping responses adopted by households, and iii) the effects on current household economic welfare (income and consumption).

We find that there is substantial economic cost due to forgone income and increased health expenditure. Although the labor supply of the household head declines due to ill-health, intra-household labor substitution limits the overall reduction in household labor supply. However, possibly due to productivity differences between the head's labor and the substituted labor and diversion of productive resources for health care, there is a decline in household income. We also find that ill-health is associated with asset depletion, increases in the probability of indebtedness and increases in the amount of outstanding loans. We did not find evidence to reject the null hypothesis of food consumption insurance against ill-health (full sample). However, non-food consumption declines for certain measures of ill-health. This effect is magnified for households with the lowest ability to self-insure.

Our quantitative results should be seen in light of two data limitations. We underscore that despite costly attempts to smooth income, there is a substantial drop in income. Our event history interviews suggest that this effect is likely to depend on whether illness occurs at a peak or slack season. Future econometric works would benefit from this distinction. Second, although our qualitative work suggests that households primarily rely on borrowing and selling livestock to finance health care, we find limited evidence for the latter. We suspect that this is due to a possible replacement of small animals over a year period (the gap between the two surveys). The fact that we use number of livestock rather than the value of livestock owned might also be responsible for this as households could sell higher quality animals and buy smaller and lower quality animals after using the difference for financing health care, for example.

The evidence assembled in this paper supports the recent move of the Government of Ethiopia to expand and scale-up a pilot community based health insurance scheme. Given the effects of ill-health on asset depletion and household indebtedness, both of which are likely to exert negative effects on consumption in the long-run, the potential benefit of such a scheme may be substantial in terms of providing protection against future vulnerability.

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Figure 1
Conduits of impoverishment due to ill-health

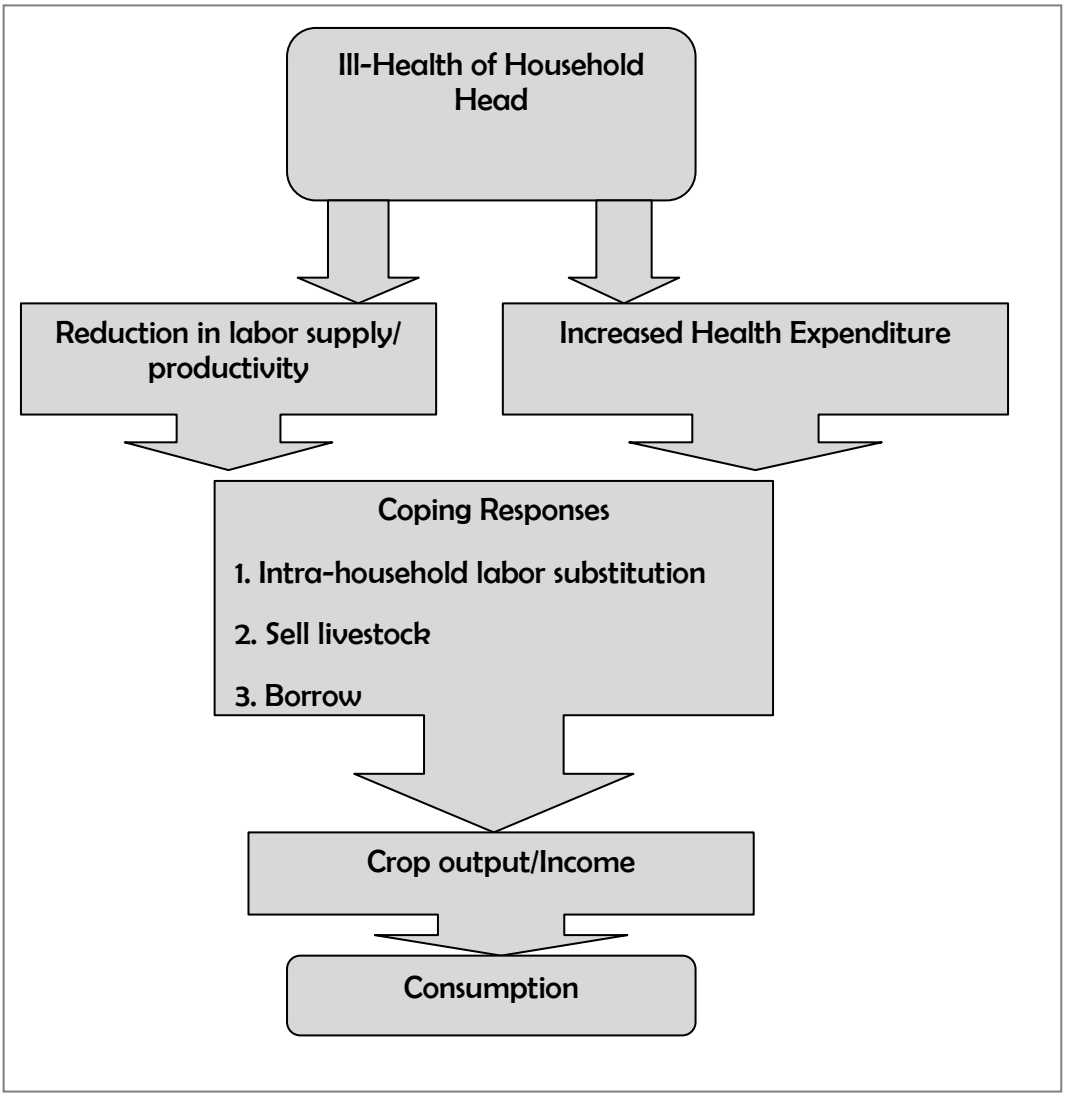

Table 1
Summary statistics of health measures of the household head

	% of heads/mean			Change (% of heads)		
Health measures	**2011**	**2012**	**2013**	**Improve**	**Same**	**Worsen**
Activities of daily living (ADL) index	0.051 (0.147)	0.058 (0.159)	0.080 (0.187)	12.3	70.1	17.6
Prolonged illness (symptoms for more than 30 days)	9.1	5.4	6.2	6.1	89.2	4.7
Illness in the two months preceding the survey	20.1	13.5	15.3	13.4	75.5	11.1
(Very) Poor Self-Assessed Health Status	6.1	6.2	8.9	4.7	89.1	6.2

Notes: All health measures except the ADL index are dummy variables. For ADL standard deviations are reported in parentheses. Number of observations for the change column of row 1,2,3 and 4 respectively are 3145, 3117, 3158 and 3164.

Table 2.
Means and standard deviations of outcome variables

Outcome variables	2011	2012	2013	Outcome variables	2011	2012	2013
Total consumption	249	367	406	Goats #	0.957	1.04	1.109
	(162)	(692)	(529)		(3.754)	(3.834)	(3.235)
Food consumption	206	303	340	Sheep #	1.331	1.365	1.377
	(138)	(679)	(515)		(2.764)	(3.153)	(2.957)
Non-food consumption	43	64	66	Calves #	0.651	0.687	0.654
	(42)	(83)	(61)		(1.019)	(1.238)	(1.944)
Crop output (year)	7758	10781	11409	Bulls #	0.366	0.338	0.371
	(14137)	(23369)	(16184)		(1.013)	(1.085)	(1.417)
Total income (year)	9354	12024	13574	Oxen #	1.061	1.031	1.042
	(17306)	(18572)	(17222)		(1.139)	(1.53)	(1.198)
Health expenditure (year)	359	393	353	Total Labor supply (household)	229	225	262
	(1276)	(1624)	(1405)		(247)	(213)	(215)
Outstanding loan	666	635	798	Total labor supply (head)	92	89	102
	(1450)	(1432)	(1970)		(77)	(76)	(82)
				Total labor supply (others)	137	137	160
					(206)	(170)	(177)

- Unless specified all flow variables are in monthly terms; standard deviations are in parenthesis

Table 3.
Effect on health expenditure, labor supply and income

	Health expenditure	Labor supply (head)	Labor supply (others)	labor supply (household)	Crop output	Total income
ADL index	1,670***	-17.06*	36.94	25.31	-3,180	-3,527
	(542.8)	(9.463)	(30.16)	(35.56)	(2,048)	(2,476)
Prolonged illness	1,108***	1.355	20.82	21.22	-1,247*	-802.3
	(301.5)	(4.767)	(12.91)	(14.17)	(637.2)	(1,933)
Illness	873.9***	-0.260	16.50**	15.52	-2,008**	-564.6
	(168.1)	(3.307)	(7.889)	(9.724)	(914.5)	(850.5)
(Very) poor SAH	792.7***	-12.23***	10.54	-4.556	-1,234*	-1,577
	(254.0)	(4.648)	(14.78)	(17.27)	(687.5)	(1,006)

Note: Each coefficient is from a separate linear regression of equation (1). Not reported but included in our specification are village fixed effects and measures of economic status, human capital, social capital, demographics, religion, year and shock dummies (See appendix).
*significant at 10%
** significant at 5%
*** significant at 1%
Clustered standard errors (at Kebele/village level) are reported in brackets

Table 4.
Effect on indebtedness and asset stock

	Any loan	Loan amount	Goat	Sheep	Bull	Calve	Oxen
ADL index	2.575**	422.3**	-0.198	-0.620**	-0.0659	-0.172	-0.164*
	(1.170)	(187.7)	(0.377)	(0.285)	(0.0856)	(0.109)	(0.0891)
Prolonged illness	1.666**	106.0	-0.152	-0.181	0.000700	0.0278	-0.0506
	(0.345)	(92.81)	(0.137)	(0.141)	(0.0463)	(0.0622)	(0.0351)
Illness	2.028***	277.1***	-0.0552	-0.0568	0.0203	-0.0139	-0.0314
	(0.295)	(86.29)	(0.0984)	(0.110)	(0.0468)	(0.0441)	(0.0289)
Poor/very poor SAH	1.820***	288.9**	-0.127	-0.364**	-0.0128	-0.0401	-0.0201
	(0.383)	(133.4)	(0.130)	(0.167)	(0.0492)	(0.0646)	(0.0394)

Notes: Each coefficient [column 2- 7] is from a separate regression of equation (1). The first column reports odds ratio from logit fixed-effects model. Not reported but included in our specification are village fixed effects and measures of economic status, human capital, social capital, demographics, religion, year and shock dummies (See appendix).
*significant at 10%
** significant at 5%
*** significant at 1%
Clustered standard errors (at Kebele/village level) are reported in brackets [column 2-7]

Table 5.
Consumption insurance

		Total	Food	Non-food
ADL index	Full sample	0.116	0.158*	0.167
		(0.0789)	(0.0816)	(0.117)
	Poor	-0.132	-0.0862	-0.165
		(0.138)	(0.153)	(0.208)
	Non-poor	0.222**	0.278***	0.280**
		(0.0958)	(0.0916)	(0.136)
Prolonged illness	Full sample	0.00522	0.0203	-0.0835*
		(0.0292)	(0.0327)	(0.0454)
	Poor	-0.0807	-0.0747	-0.150*
		(0.0516)	(0.0653)	(0.0888)
	Non-poor	0.0424	0.0603	-0.0530
		(0.0430)	(0.0447)	(0.0649)
Illness	Full sample	0.000158	0.00873	-0.0328
		(0.0287)	(0.0295)	(0.0352)
	Poor	-0.0551	-0.0392	-0.0510
		(0.0627)	(0.0618)	(0.0765)
	Non-poor	0.0114	0.0190	-0.0326
		(0.0306)	(0.0319)	(0.0394)
(Very) poor SAH	Full sample	0.0119	0.0262	-0.00925
		(0.0382)	(0.0389)	(0.0512)
	Poor	-0.121	-0.0922	-0.265***
		(0.0793)	(0.0836)	(0.0929)
	Non-poor	0.0590	0.0709	0.0775
		(0.0432)	(0.0440)	(0.0554)

Note: Each coefficient is from a separate linear regression of equation (1). Not reported but included in our specification are village fixed effects and measures of economic status, human capital, social capital, demographics, religion, year and shock dummies (See appendix). All dependent variables are log-transformed.
*significant at 10%
** significant at 5%
*** significant at 1%
Clustered standard errors (at Kebele/village level) are reported in brackets

Appendix

Table 3A
Effect on health expenditure, labor supply and income (robustness check for CBHI inclusion)

	Health expenditure	Labor supply (head)	Labor supply (others)	Labor supply (household)	Crop output	Total income
ADL index	1,670***	-17.01*	36.56	25.16	-3,132	-3,484
	(540.8)	(9.528)	(30.15)	(35.63)	(2,049)	(2,469)
Prolonged illness	1,108***	1.406	20.95	21.39	-1,247*	-805.7
	(301.9)	(4.766)	(12.94)	(14.22)	(638.4)	(1,931)
Illness	876.3***	-0.188	16.68**	15.84	-2,017**	-591.8
	(168.6)	(3.316)	(7.918)	(9.751)	(910.2)	(852.2)
(Very) poor SAH	792.4***	-12.23***	10.62	-4.476	-1,232*	-1,559
	(253.7)	(4.638)	(14.82)	(17.33)	(688.4)	(1,005)

Note: Specification is exactly the same as Table 3 except the inclusion of CBHI dummy

Table 3B.
Effect on health expenditure, labor supply, income and loan
(Log (Y+1) dependent variable)

	Health expenditure	Labor supply (head)	Labor supply (others)	labor supply (household)	Crop output	Total income	Loan amount
ADL index	1.415**	-1.123***	0.0671	-0.241	-0.851**	-0.629	1.193**
	(0.646)	(0.245)	(0.328)	(0.251)	(0.336)	(0.405)	(0.471)
Prolonged illness	2.118***	-0.218*	0.174	0.0730	-0.342**	-0.399**	0.615**
	(0.288)	(0.128)	(0.165)	(0.110)	(0.154)	(0.179)	(0.246)
Illness	2.732***	-0.195***	0.305***	0.117*	-0.127	-0.217**	0.676***
	(0.193)	(0.0719)	(0.100)	(0.0609)	(0.0978)	(0.0998)	(0.161)
(Very) poor SAH	1.641***	-0.572***	0.128	-0.130	-0.266*	-0.375**	0.620**
	(0.322)	(0.118)	(0.188)	(0.117)	(0.141)	(0.147)	(0.237)

Note: Each coefficient is from a separate linear regression of equation (1). Not reported but included in our specification are village fixed effects and measures of economic status, human capital, social capital, demographics, religion, year and shock dummies. All dependent variables are log-transformed (log(Y+1)).
*significant at 10%
** significant at 5%
*** significant at 1%
Clustered standard errors (at Kebele/village level) are reported in brackets

Table 3C.
Effect on health expenditure, labor supply, income and loans
(Quartic root dependent variable)

	Health expenditure	Labor supply (head)	Labor supply (others)	labor supply (household)	Crop output	Total income	Loan amount
ADL index	1.548**	-0.777***	0.0783	-0.139	-1.091**	-0.873	1.046**
	(0.614)	(0.167)	(0.242)	(0.191)	(0.448)	(0.530)	(0.405)
Prolonged illness	1.919***	-0.144	0.138	0.0713	-0.532***	-0.469*	0.515**
	(0.268)	(0.0886)	(0.120)	(0.0842)	(0.179)	(0.250)	(0.213)
Illness	2.314***	-0.127**	0.217***	0.0938*	-0.277**	-0.253*	0.609***
	(0.176)	(0.0500)	(0.0726)	(0.0485)	(0.120)	(0.134)	(0.146)
(Very) poor SAH	1.481***	-0.396***	0.0945	-0.0918	-0.370**	-0.473**	0.555***
	(0.302)	(0.0820)	(0.138)	(0.0937)	(0.171)	(0.191)	(0.206)

Note: Each coefficient is from a separate linear regression of equation (1). Not reported but included in our specification are village fixed effects and measures of economic status, human capital, social capital, demographics, religion, year and shock dummies (See appendix). All dependent variables are transformed in to their quartic roots.
*significant at 10%
** significant at 5%
*** significant at 1%
Clustered standard errors (at Kebele/village level) are reported in brackets

Table 3D.
Effect on health expenditure:
Poison fixed effects and two part models

	Poisson fixed effects	Two part models: Cross-section		
		Probit (First part)	OLS in log (Second part)	GLM (second part)
ADL index	2.600***	0.280***	1.087***	1.559***
	(0.556)	(0.0711)	(0.288)	(0.309)
Prolonged illness	1.483***	0.384***	0.534***	0.628***
	(0.211)	(0.0307)	(0.104)	(0.123)
Illness	1.562***	0.484***	0.321***	0.340***
	(0.159)	(0.0240)	(0.0836)	(0.102)
Poor/very poor SAH	0.996***	0.304***	0.342***	0.483***
	(0.210)	(0.0363)	(0.111)	(0.134)

Note: Each coefficient is from a separate regression. Control variables include measures of economic status, human capital, social capital, demographics, religion, shock dummies, year dummies and village dummies.
*significant at 10%
** significant at 5%
*** significant at 1%

- Robust standard errors [column 1] and standard errors clustered at Kebele/village level [column 2-4] are reported in brackets
- GLM is estimated using log link and gamma distribution

Table 4A.
Effect on indebtedness and asset stock
(robustness check for CBHI inclusion)

	Any loan	Loan amount	Goat	Sheep	Bull	Calve	Oxen
ADL index	2.646**	420.9**	-0.203	-0.622**	-0.0656	-0.170	-0.165*
	(1.209)	(188.0)	(0.377)	(0.284)	(0.0856)	(0.109)	(0.0889)
Prolonged illness	1.680**	105.7	-0.149	-0.181	0.000665	0.0274	-0.0505
	(0.349)	(92.92)	(0.137)	(0.141)	(0.0463)	(0.0623)	(0.0351)
Illness	2.065***	277.4***	-0.0538	-0.0569	0.0200	-0.0131	-0.0323
	(0.302)	(86.24)	(0.0982)	(0.110)	(0.0468)	(0.0442)	(0.0290)
Poor/very poor SAH	1.813***	289.0**	-0.127	-0.364**	-0.0126	-0.0406	-0.0197
	(0.383)	(133.4)	(0.130)	(0.167)	(0.0492)	(0.0646)	(0.0394)

Note: Specification is exactly the same as Table 4 except the exclusion of dummies for shocks

Table 5A.
Consumption insurance
(robustness check for CBHI inclusion)

		Total	Food	Non-food
ADL index	Full sample	0.117	0.159*	0.167
		(0.0787)	(0.0814)	(0.117)
	Poor	-0.132	-0.0857	-0.165
		(0.139)	(0.153)	(0.210)
	Non-poor	0.222**	0.279***	0.280**
		(0.0952)	(0.0908)	(0.136)
Prolonged illness	Full sample	0.00450	0.0198	-0.0840*
		(0.0294)	(0.0329)	(0.0454)
	Poor	-0.0808	-0.0750	-0.150*
		(0.0517)	(0.0654)	(0.0888)
	Non-poor	0.0406	0.0589	-0.0540
		(0.0430)	(0.0449)	(0.0647)
Illness	Full sample	0.000358	0.00913	-0.0332
		(0.0286)	(0.0293)	(0.0354)
	Poor	-0.0551	-0.0392	-0.0509
		(0.0628)	(0.0618)	(0.0764)
	Non-poor	0.0108	0.0186	-0.0338
		(0.0303)	(0.0318)	(0.0395)
(Very) poor SAH	Full sample	0.0114	0.0257	-0.00929
		(0.0383)	(0.0392)	(0.0513)
	Poor	-0.121	-0.0931	-0.266***
		(0.0794)	(0.0838)	(0.0927)
	Non-poor	0.0569	0.0686	0.0766
		(0.0429)	(0.0437)	(0.0554)

Note: Specification is exactly the same as Table 5 except the inclusion of CBHI dummy