M.Sc. 2011

FARM BASED HOUSEHOLD HEALTH STATUS AND INCOME: EVIDENCE FROM TIGRAY, NORTHERN ETHIOPIA

FARM BASERT HUSHOLDNING HELSE STATUS OG INNTEKTER: BEVIS FRA TIGRAY, NORDLIGE ETIOPIA

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MASTER THESIS 30 CREDITS 2011

Declaration

I, John Paul Tugume, do hereby declare the originality of my work, and wholeheartedly do acknowledge the use of all materials other than my own work. This work has not been submitted to any other university than Norwegian University of Life Sciences (UMB) for any type of academic degree or publication.

May 12, 2011
Ås, Norway

Acknowledgement

First and foremost I'm very thankful to my supervisor Mette Wik (prof.) who has been helping me and advising me on thesis writing in every possible way. This paper could not have been finalized without her intensive supervision and tireless efforts.

Many thanks to our coordinators and mentors Prof. Stein Terje Holden, Prof. Ragnar Øygard and the whole administration of the Norwegian University of Life Sciences (UMB) who coordinated the field work and made sure that all I needed was provided.

I'm also thankful to the Norwegian University of life sciences (UMB), which not only granted me the admission to the university but also covered my field work in Tigray Region, Northern Ethiopia. Likewise, I appreciate The NOMA program which granted me the scholarship to study at the Norwegian University of Life sciences (UMB).

Also special thanks to Hosae'na Ghebru Hagos and Bethlehem Legesse who were helping me during the field work in Tigray, your advice will always be cherished. I would like to extend thanks to my fellow NOMA students who joined me during the field work in Tigray (Northern Ethiopia) Duba Jarso, Christine Kawuma, Mary Nantongo, Thomas lemma, Gebreselassie Hailu, Kibrewossen Abay, Achamleyah Tamiru, Kondwani Nyirongo, Woubit Alemayehu, Teame Hailemariam and Martin Mailosi who ensured neatness and accuracy of data as much as possible during the data collection.

Finally, the efforts of field enumerators and data entrants cannot go without mention because of the role played to process the data with quality and in time.

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Abstract

This aim of the thesis is to answer research questions such as: Is there a relationship between the number of days lost to sickness by farmers and percapita crop income? Does access to clean/safe drinking water affect household percapita crop income? Does information on water preparation have an effect on percapita crop incomes of farmers?

The thesis utilizes Instrumental Variables Methods (IV) using household survey data to analyze the effect of farmers' health status on percapita crop income in Tigray, Northern Ethiopia. The model results showed that the number of days spent sick is an endogenous variable which depends on the distance to the health center, access to clean water and information on water preparation and the tests confirmed that the instruments were very strong. The paper concludes that investment in health care system by increasing access to medical facilities and ensuring that households have access to clean water will go in the direction of reducing the number of days spent sick which again, affects percapita crop income positively.

Key words: Instrumental variables, health status, percapita crop income, Ethiopia

List of Tables

Table of Contents

Chapter one

Introduction

Governments in developing countries and development agencies such as the World Bank have been considering improvements in human capital development components such as education, nutrition and health status as the main forces to increase incomes at household levels and reduce poverty.

Therefore increased knowledge of the interaction between income, nutrition and health status is required in designing policies and programs and more especially the current Millennium Development Goals (MDGs). The growing importance of the impacts of programs/policies on nutrition and health has led to many scholars addressing the question of how income, current developments in the agricultural sector such as river dam construction and demographic factors affect health and nutritional status Lautze *etal* (2007).

The importance of the role of health in promoting economic development has been highlighted by Sachs (2001) in the Report of the Commission on Macroeconomics and Health. Indeed, improvements in health care increase the productivity of labor, especially if people switch from low to high productivity jobs as their health improves. In particular, there is strong evidence that growth in early industrialized countries was associated with significantly increased caloric intake and therefore greater height and a higher Body Mass Index Fogel (2004). In addition, good health interacts positively with schooling: healthy children learn more in school and are more likely to stay in school (Bhargava (2001); Miguel (2004)). In addition, improved levels of health may increase the rate of return to further investments in other components of human capital such as nutrition.

According to Schiff and Valdes (1990), there are many factors affecting nutritional well-being and health in developing countries. Among the most documented determinants are income,

education, condition of housing, quality of drinking water, sanitation and availability of medical care.

Health is an important form of human capital. It can enhance workers' productivity by increasing their physical capacities, such as strength and endurance, as well as their mental capacities, such as cognitive functioning and reasoning ability. We expect to see a positive relationship between components of health and agricultural income for farmers. Evidence of this link is increasing at the microeconomic level (Savedoff (2000); Schultz (1999a); Schultz (1999b); Schultz (2002); Schultz (1992); Strauss (1998)). This link may not be well observed in economies with well functioning markets but it may be visible with less functioning markets such as the developing economies. This is because with a well functioning market, farmers can hire labour to substitute for the absent labour and production, consequently production will not be affected keeping other factors constant.

Other studies have emphasized the relationship between food prices and household nutrient consumption. Pitt and Rosenzweig (1986) studied farm households in Indonesia and found that almost all food price alterations, downward or upward, resulted in absolute declines in one or more nutrients consumed by the household. This is due to the profit effect experienced by farmers. Thus the impact of health cannot be known without additional information on the relative magnitudes of the nutrient consumption changes and their impacts on measures of health or well-being among individuals. Strauss's study (1984) from rural Sierra Leone, found that increased food prices lead to increased calorie availability for the producers made possible by increased income.

Looking at the problem from another perspective, Bliss and Stern (1978) argue that poor health and nutritional status is not only the result of low productivity of labour, but also is a cause of low productivity. To avoid low productivity of the labour-force, employers might pay wages higher than required by market equilibrium. If wages drop below a certain level, the nutritional

status of the workers will be so poor that the productivity loss for the employer (due to poor health and nutrition) will be greater than the reduction in costs from lower wages)

Bliss and Stern (1978) discuss how wages and productivity might be influenced by nutritional and health status. They do not discuss how production and income among peasants might be affected by their well-being and health status. Various studies have tried to show the relationship between health and income of farm households but they do not specifically look at how the number of days spent sick or looking after the sick affect crop percapita income. The only recent study concerned with the effects of health on income and agricultural efficiency from rural Ethiopia is by Ulimwengu (2009)using a stochastic production frontier he concluded that reducing village remoteness might sensibly reduce the probability of being handicapped by sickness which in turns improves farmer's agricultural efficiency.

This research paper utilizes cross- sectional data collected between May and July 2010 from Tigray Region in Northern Ethiopia. This research in Tigray, Northern Ethiopia is particularly important because; Ethiopia has extremely poor health status relative to other low-income countries, even within Sub-Saharan Africa (WHO, 2003/04). This largely attributes to preventable infectious ailments and nutritional deficiencies. Widespread poverty along with general low income levels of the population, low education levels (especially among women), inadequate access to clean water and sanitation facilities, a high rate of migration, and poor access to health services have contributed to the high burden of ill-health in the country. This situation is further aggravated by high population growth 3.1% on average
(Ministry of Health, 2002)

Therefore this research paper aims at answering such questions as: 1) Is there a relationship between the number of days lost to sickness by farmers and percapita crop income?
2) Does access to clean/safe drinking water affect household percapita crop income?
3) Does information on water preparation have an effect on percapita crop incomes of farmers?

Chapter 2 discusses the literature review and the relevant studies that have tried to show relationships between health and income and further discusses the Farm household models used. Chapter 3 discusses the data, source of data and descriptive statistics. Chapter 4 discusses the methodology and instrumental variable model adopted. Chapter 5 discusses data analysis, the regression model and various tests for the instruments. Chapter 6 outlines the conclusions made from the analysis.

Chapter two

Literature review

Empirical evidence on the link between health and agricultural productivity is based on the extension by Pitt and Rosenzweig (1986) in the agricultural household models. In agricultural communities poor health reduces income and productivity, further decreasing people's ability to address health problems and inhibiting economic development, Hawkes and Ruel (2006). Using cross-sectional data on hoe-cultivating farm household data from Sierra Leone, Strauss (1986) investigated the efficiency wage hypothesis, or the relationship between nutritional quality and agricultural productivity. He found that 'effective family labor', which is a function of actual labor and per capita daily calorie intake, is a significant input in the production process. His study shows a highly significant effect of calorie intake on labor productivity. However, working with panel data from rural South India, Deolalikar (1988) did not find similar results. Neither market wages nor farm output was observed to be responsive to changes in the daily energy intake of workers. However, both were highly elastic with respect to weight-for-height.

Various studies have tried to provide the link between ill-health and productivity at micro level. Concerning HIV/AIDS and agrarian livelihoods, there is plentiful evidence, principally drawn from small-scale studies in Eastern, Central and Southern Africa, (WHO/FAO (2002); Haddad and Gillespie (2001)), and the conclusion is that agrarian households are affected as labour is drawn from farm work to attending to the sick and this reduces agricultural productivity. Oyekale and Adeoti (2010), analyzed allocative efficiency of food production by farmers affected by HIV/AIDS in the rainforest belt of Nigeria. Results showed that inefficiency significantly increased with HIV/AIDS infection, market distance, farm days lost, market days lost and the average overall allocative efficiency for the HIV/AIDS affected farmers was 27.55% less than for non-affected.

However, the effect of farmers' well-being on productivity is mixed: Gilgen *etal* (2001) investigated the effect of iron supplementation and anthelmintic treatment on the labour productivity of adult female tea pluckers using a randomized clinical intervention trial over 24 weeks on a tea estate in north-east Bangladesh. No significant difference in labour productivity was found between the intervention groups over the trial period, but a negative association existed between the intensity of helminth infections and all measures of labour productivity. Taller women with greater arm circumference were able to pluck more green leaves, earn higher wages and were absent less often.

Using a quasi-experiment design, Audibert and Etard (1998) studied the economic impact of schistosomiasis in 412 rice-grower households in Mali. Effect of treatment was assessed according to economic output (paddy yield) and five resource variables (family and hired labour productivity, family and hired labour intensity and farm size). Unlike Pitt and Rosenzweig (1986), the study showed that changes in health have no direct effect on rice production, but affect the household's use of its labour resources and its ability to utilize other resources: increases of 69 man-days available per hectare (for family workers) and of 0.47 hectares in farm size were observed in the treated group relative to the untreated group. These results illustrate the key role of the coping process in masking the direct economic effects of disease. The benefit of reducing the burden of disease was confirmed through provision of additional utility to households by increasing the time available for leisure activities or for work.

In a study done in Nigeria to analyze effects of Onchocercal Skin Disease (OSD) on farmers' production, Oladimeji *etal* (1997) found that farmers with OSD had significantly less farmland under cultivation (9117 m^2) than those with no OSD (13850 m^2). The farmers with OSD did not appear to have alternative income strategies to compensate for the time and income lost to sickness and, consequently, they had a lower value of personal wealth indicators (e.g. iron sheet roofing, motorcycle) than those without OSD. More evidence is provided by Kim *etal* (1997) in

analyzing the impact of Onchocercal Skin Disease (OSD) on productivity at a coffee plantation in South West Ethiopia. Their results revealed that permanent male employees, the core of the plantation labor force, suffered significant losses in economic productivity (in the form of lower daily wages earned) as a result of OSD. Depending on the severity of the disease, and controlling for factors such as age, daily wages were 10 to 15% lower among those with skin-related problems. Relatively older (35+), permanent male employees had the biggest OSD-related loss in economic productivity in terms of diminished earnings, and labor supply was adversely affected.

2.1 Theoretical Models

The model used is based on an extension of the basic producer-cum-consumer model presented by Singh (1986) and the term paper by Wik (1992).This farm household model helps to show the relationship between market prices, health, production, income and consumption. A similar model including health was also used by Pitt and Rosenzweig (1986). Improved (deteriorated) health status results into both improved (reduced) quality of labour, as well as an increase (reduction) in time available for leisure or work.

For the purpose of this research paper, the time-effect of health is included in the theoretical model. This is a theoretical discussion of the signs of changes (not the magnitudes) in farm profits and income as a result of improved health.

However, it should be noted, that the value of the marginal changes in lost work days because of illness will understate the total returns from investments in health when health also affects workers efficiency.

2.2 The farm household model

First, the household model is presented where it is assumed that there is one farm- produced output, produced with one variable input, labour and a fixed input capital in form of oxen. There is one member of the family, the adult farmer. The farmer gets utility from consuming

the food commodity produced at the farm (X), purchased food (Y), public good (G) such as a road, protected water source, leisure (L), and from his or her level of health (H). All these commodities are assumed to be normal goods.

$$U = U(X, Y, G, L, H)$$

Where U is a quasi-concave, continuous and non- decreasing utility function.

Further, it is assumed that the farmers level of health is influenced by food consumption, consumption of the public good, consumption of health inputs (Z) like medicines and access to medical care, and by exogenous health factors (μ) like availability of clean water, prevalence of disease, genetic endowments, information about health and sanitation etc.

$$H = h(X, Y, G, Z) + \mu$$

The health production function describes how changes in food consumption, public goods consumption, health inputs and the health environment affect farmers' health. Without arguing why, Pitt and Rosenzweig (1986) include leisure in their health production function. In most developing countries, the amount of leisure is not an important determinant of health, thus I have not included it in my model. In some periods when demand for labour peaks, however, the amount of rest might affect the health-level.

As in other production-functions, technologies might change over time and influence farmers' health. Farmers' knowledge of the health production function (knowledge about healthy food, sanitation etc) and of new health technologies can vary significantly among farmers, and is important to determine farmers' health.

In constructing a model of the demand for the commodity ''good health'', Grossmann (1972) argued that increased health increases the number of days available for work (L_f) and leisure (L_s). As mentioned in the introduction to this section, this is the only effect of health except for the effect on utility I will include in my model.

$$T = T(H) = L_f + L_s$$

Farmers produce the amount Q, of the food commodity, X. Production is a function of the input labour (L), a fixed amount of capital in form of oxen (K^I) and a fixed amount of land(A^I).

$Q = Q(L, K^I, A^I)$

When p_x ,p_y ,and p_z are the market prices of X, Y and X, ω is the market wage rate, I is the income and profit $\pi = p_x Q(L, K^I, A^I) - \omega \mathrm{L}$, we find the budget constraint of the house hold to be:

$$p_x X + p_y Y + p_z Z + \omega \mathrm{L} = \pi + \omega \mathrm{T(H)} = \pi + \omega L_f + \omega \mathrm{L}$$

$$p_x X + p_y Y + p_z Z = \pi + \omega L_f = \omega(\mathrm{T\ (H)} - \mathrm{L}) = \mathrm{I}$$

The public good, G was not included in the model because the users do not pay user fees but as noted in the previous section it enters directly into the utility function.

In many developing countries we will find well functioning commodity markets, but missing credit and insurance markets. Sometimes we will also find missing labour markets. The most common cause of market failure in developing countries is lack of access to credit, which causes factors that enter in the liquidity constraint to be marked upwards by the shadow price of credit Sadoulet (1995). In most developing economies usually we have two cases: a missing credit market and a missing labour market but not both at the same time.

2.3 Case 1: When there is a missing credit market

This section shows how health might affect farm profits when we have a missing credit market. In this situation the farmer needs to finance his/her consumption and hired labour through savings and or remittances (R) and gifts from relatives. The farmer will now have a liquidity constraint in addition to the budget constraint:

$$\omega(\mathrm{L} - \mathrm{T\ (H)} - \mathrm{I}) + p_x X + p_y Y + p_z Z \leq \mathrm{R}$$

The Lagrangian equation is as follows:

$$L_a = U(X, Y, G, L, H) + \lambda(p_x\, Q(L, K^I, A^I) - \omega \mathrm{L} + \omega(\mathrm{T\ (H)} - \mathrm{I}) + \mathrm{R} - p_x X - p_y Y - p_z Z) + \alpha(R - \omega\left(\mathrm{L} - (\mathrm{T\ (H)} - \mathrm{I})\right) - p_x X - p_y Y - p_z Z)$$

The necessary order condition will be:

$$\omega\left(\mathrm{L} - (\mathrm{T\ (H)} - \mathrm{I})\right) + p_x X \leq R$$

This occurs because the farmer faces the input constraint at the beginning of the planting season.

We find that when the liquidity constraint is binding the model is no longer recursive, and farmers now have to make consumption and production decisions simultaneously. As long as the liquidity constraint is binding, the household's price of labour deviates from the market wage rate. Since α will be positive when the constraint is binding, we find labour to be more expensive than the wage rate, thus the household will use less labour. Assuming a constraint relationship between leisure and work (i.e. we know the preferences of the household) we see from the liquidity constraint that when available time increases through health improvements the constraint will be less binding and labour will become cheaper. But as long as we do not know the utility function of the farmer, we cannot tell whether the farmer will use the increase in available time as work or leisure. We cannot tell, therefore, how a small change in health will influence farm profits. Looking at the extreme case where the farmer becomes ill and has to stay in bed for a longer period (i.e. there is no time available for either work or leisure), we see that the constraint will be more binding and that health therefore will influence farm profits, Wik (1992).

2.4 Case 2: when there is a Missing labour market

The following section discusses the way a health change might affect farmers' production when there is no labour market. In this case the farmer will not be able to substitute his/her own labour with hired labour, and there is no possibility of selling his/her excess labour in the labour market. The farmer is now confronted with two constraints, the budget constraint:

$$p_x \mathrm{X} + p_y Y + p_z Z = \pi = p_x Q(L, K^I, A^I) + R$$

And time constraint:

$$\mathrm{T(H)} = L_f + L_e$$

The Lagrangian function will look like:

$$L_a = U(X, Y, G, L, H) + \lambda(p_x\, Q(L, K^I, A^I) + \mathrm{R} - p_x X - p_y Y - p_z Z) + \alpha(\mathrm{T(H)} - L_f - L_e)$$

The necessary first order condition with respect to labour will be:

$$p_x\, Q_{L_f} = \frac{\alpha}{\lambda}$$

We now find that farm production and thus farm profit is dependent upon both shadow price or income and the shadow price of time. There will now be an endogenous determined price for labour equal to $\frac{\alpha}{\lambda}$. This is consistent with the discussion in deJanvry *etal* (1991). We see that when α increases (i.e. the time constraints get more binding), the endogenous price of labour increases and production decreases. We also see that when health improves, the time constraint becomes less binding, labour becomes cheaper and production and thus farm profits ('ceteris paribus') increase. In this situation we do not need to know the household's preferences regarding work or leisure. When more time is available, time gets cheaper, as does the endogenous price of labour. Furthermore, we find that the endogenous price of labour is also dependent upon the shadow-price of income, and thus the price of the commodities produced and consumed. When for example, the price of the commodity produced at the farm rises, the constraint in the model becomes less binding and the shadow price of income decreases. This will lead to a higher price of labour, and thus reduced production of the commodity. This surprising, but interesting theoretical result-that increased prices of a commodity might lead to reduced supply of the commodity-is thoroughly elaborated in deJanvry *etal*. It is worth mentioning that this endogenous price might give an explanation to developing countries' government officials who complain that peasants are not responsive to price-incentives, or to scientists arguing that peasants are not utility maximisers.

In this situation with a missing labour market, the only possible income source is farm – production. We have seen that in the non-recursive model with a missing labour market, farm profits will be affected by health. Through increased availability of time, improved health will lead to cheaper labour and thus to increased production and farm profits. We have seen how increased health may increase total income. In addition to increasing income we also have an increased utility effect since health is a parameter in the utility function. Thus we are still in a

situation where welfare change cannot be measured through the change in income. Earlier we assumed that increased consumption of X, Y and Z has a positive effect on health ($h_x, h_y, h_z, h_G > 0$) and increased income leads to augmented consumption of X, Y, Z, G. In this context we will have an additional positive effect on health, which again might lead to increased income, etc. Following the same arguments above if the health status is reduced the farmer could easily get caught in a vicious circle, where reduced health leads to reduced income and reduced income leads to further reduction in health Wik (1992). This is often the case for marginal farmers in developing countries. If the farmer has a reduced harvest because of some exogenous factor in one year, he might find himself and his family with little food when it is time to devote labour to the next crop. If the family cannot provide the necessary labour because of poor health, and there are no credit and/or labour markets, the following harvest might be even poorer than the previous one. These and several other types of seasonal variability are discussed in Sahn (1989).

Therefore based on the above arguments, the main objective of the study is to investigate the relationship between Households' health status and household percapita agricultural income and specifically by testing the following hypotheses.

Hypothesis 1: There is a negative relationship between the days lost to sickness and percapita crop income. The more days a household member is sick, the more days dedicated to the attention of the sick and the fewer days dedicated to work and therefore less income of the household.

Hypothesis 2: Access to clean water and distance to health center have a positive effect on percapita crop income. The two variables affect percapita income indirectly through the number of days spent sick or looking after a sick person.

Hypothesis 3: information on water preparation affects percapita agricultural household income positively. This variable also affects percapita crop income indirectly through the number of days spent sick or looking after a sick person.

Chapter three

Data and descriptive statistics

3.1 Data source and method of collection

The data was collected from Tigray in Northern Ethiopian Highlands. Data collection was carried out in 17 tabias (villages) using a structured questionnaire between June and July 2010. From each village 25 households were selected randomly for interview. The data was collected by the researcher with other students alongside enumerators from the Tigray region. The villages were selected based on agro-ecological characteristics and market access factors such as distance to all weather roads and distance to Woreda market. The survey was done based on the previous surveys which had been done in 1998, 2000, 2003, and 2006. The survey had 6 questionnaires ranging from household questionnaire which was mainly capturing the household and individual basic characteristics, plot questionnaire which captured information on plot and land characteristics; perception questionnaire both main sample and partner questionnaire which captured information on the impacts on the land law reforms in Tigray; Local Land Administration Committee (LAC) questionnaire which captured information on land law reforms and land management issues, Community questionnaire and Malaria questionnaire which captured information on health of a household and information on Malaria. The enumerators were selected on the basis that they can speak the local language, English language had knowledge of the survey area and also that they were well acquainted with the geographical area and the culture of Tigray. Training and pretesting of the questionnaires was done to ensure that the enumerators understood the terms used in the questionnaire and also to ensure that the questionnaires were minimized of errors.

Data collection also involved following up the enumerators to ensure that problems of just filling in the information without visiting the household were reduced. Data entry was done using excel and was managed by mainly 3 data entrants. Data cleaning was done to ensure that errors were minimized. The main challenges faced during survey were:

1) Absence of household heads for interview since the time of the survey coincided with the peak time of harvesting and tilling land.

2) Respondents getting tired since majority of the questionnaires were quite lengthy.

3) The problem of households recalling the information prior to the survey.

4) Households could not give correct information because they thought that information could be given to the tax authorities and refusal to respond due to cultural and religious prohibitions. Data collection also had one main person who coordinated and supervised the collection and entry of data.

3.2 Description of variables used in the model

Table 3.1: Description of main variables in the model

variable name	Description of the Variable name	Type of Variable
hhage2	head of household age squared	continuos
laborloss	number of days lost for being sick/tending to sick	continuos
infowaterprep	information on water preparation (0=no, 1=yes)	discrete
flabor	Number of adult female labour	continuos
mlabor	Number of adult male labour	continuos
dratio	Dependency ratio	continuos
hhsex	Sex of Household Head (0=male, 1=female)	discrete
hhage	Age of Household Head	continuos
disthealth	Distance to health center(walking minutes)	continuos
distapwtr	Access to clean water (walking minutes)	continuos
hhedu	Education of Household Head (1=illiterate, 3=literate…..	categorical
income	Total agricultural income (Birr)	continuos
distranspo	Distance to transportation sevice(walking minutes)	continuos
distwrda	Distance to woreda town(walking minutes)	continuos
distmkt	Distance to local market(walking minutes)	continuos
areaplanted	Areaplanted(tsimdi)	continuos

The variables used in the model are those thought to affect per-capita household agricultural income; they range from individual, household and village level characteristics. The individual characteristics include: age, sex, education, skill and occupation. Household level data include: household size, dependency ratio, percapita agricultural income, labourloss which is the number of days spent sick or looking after a sick person, number of times in contact with the health

extension agent, information on sanitation and household endowments of labour which include male labor force and female work force. Table 1 summarizes the variables used.

Laborloss in the model refers to the number of days lost without working on the farm due to being sick or attending to a sick member within the household. This is one of the main variables in the model. This variable is thought to be endogenous and depends on distance to the health center, access to clean water and information on sanitation. This variable is taken as a proxy for other household general sicknesses because in the data it refers to number of days spent sick or looking after a sick person from malaria.

Percpincome in the model refers to total crop income which is the income received by the farmer and aggregated then divided by the total members in the household. Agricultural income includes subsistence income and cash income from selling crops.

Table 3.2: Summary of the major variables used in the model

Variable	Obs	Mean	Std .Dev	Min	Max
percpincome	665	884.7417	773.5365	0	4304
hhage2	665	3056.364	1517.701	784	8281
laborloss	238	6.701681	8.548649	0	60
infowaterp~p	594	.8552189	.3521766	0	1
flabor	665	1.569925	.8546458	0	5
mlabor	665	1.834586	1.288155	0	6
dratio	665	.4164125	.2223349	0	1
hhsex	665	1.240602	.4277705	1	2
hhage	665	53.64812	13.36082	28	91
disthealth	660	39.65303	29.29784	2	180
distapwtr	556	17.06475	10.90166	4	60
hhedu	665	1.888722	1.214722	1	7
income	665	4704.343	3559.275	0	25080
distranspo	660	80.51061	86.55477	1	420
distwrda	660	136.1288	100.7109	0	420
distmkt	468	85.83333	65.36874	5	420
areaplanted	665	6.349005	13.26582	0	152.79

3.3 Description of empirical data

Table 3.2 shows household, individual and village level characteristics. From the table the following can be summarized; a household loses on average approximately 7 days because of being sick or attending to a sick member within a household, 86% of the households reported to have had information on water preparation, the average number of members within a household is 6 which also may imply a high dependency ratio, the dependency ratio is 43%, the average age of the head of the household is approximately 54 years which implies that majority of the households are headed by adults, the average distance to a woreda market is approximately 272 minutes walk, meaning that a household loses 272 minutes of working time moving to and back from the woreda market also the household spends on average 164 minutes walking to and fro a local market, the average distance to a health center is approximately 40 minutes walk, implying that a household that experiences sickness spends approximately 40 minutes of working time to reach the health center and an additional waiting time; the average annual crop income of a household is approximately 4704 Ethiopian Birr and the average annual percapita crop income of the household is approximately 885 Ethiopian Birr[1]. For the land characteristics, the average planted area is approximately 6 tsimdi.

The percapita crop income comprises the value of household crop consumption and income from selling crops. Income from the sale of durable assets such as sale of radios, income from participation in the rural non-farm income activities and livestock was excluded in the computation of income

The variable labourloss is the number of days lost without working or looking after a sick person due to malaria. This variable is taken to be a proxy for number of days lost without working due to other sicknesses.

[1] USDollar= 16.5763 Ethiopian Birr

Chapter four

Methodology

4.1 Model specification

Taking into the number of days the adult farmer is sick or not participating in farming due to sickness, estimation of the model involves having purely exogenous variables and endogenous variables. Included in the model are the household characteristics such as age, sex, education, etc and plot level characteristics such as plot size to take into account that different farmers have different plot sizes of land; the number of days the adult farmer is sick which depends according to the researcher on distance to the health center, access to clean water and the information on water preparation in the household. The purely exogenous factors are labour endowments factors such as the number of adult male labour and female adult work force. This gives a starting point of the discussion of how variables affect directly or indirectly agricultural incomes of the households.

Specifically the researcher aimed at estimating the following model;

$$percapincome = f(hhage, hhage2, hhsex, hhedu, laborloss, areaplanted, mlabour, flabour)$$

And

$$laborloss = f(disthealth, access\ to\ clean\ water, information\ on\ water\ prepation)$$

The procedure involved in estimating the above model is discussed in detail in the next section, which clearly showed how the instrumental variable procedure was employed.

4.2 The Instrumental Variable (IV) regression econometric model

The instrumental Variable (IV) model is formulated for each individual farmer. Let Y_i denote, percapita agricultural income of farm-household i,$i = 1, \dots, n$; where n is the number of households surveyed.

$$Y_i = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki} + \beta_{k+1} W_{1i} + \cdots + \beta_{k+r} W_{ri} + \alpha_i + u_i \qquad (1.1)$$

$X_{1i}, \dots, X_{ki}$ denote individual characteristics (age, sex, education etc) which vary across individuals and overtime. $\beta_0, \beta_1, \dots \beta_k, \beta_{k+1} \dots, \beta_{k+r}$ are the parameter coefficients and they are different for each variable. u_i, the error term captures measurement error or omitted factors and α_i is the latent unobserved heterogeneity among the different farmers in the survey. Estimation of the above model is based on a number of IV regression assumptions as presented by Stock and Watson (2006).

The above model is estimated using the Two Stage Least Squares (TSLS) in two stages.

1). First- stage regression(s): Regress X_{1i} (number of days the farmer is sick) on the instrumental variables $Z_{1i}, \dots, Z_{mi}$(distance to the health center, access to clean water and information on water preparation) and the included exogenous variables ($W_{1i}, \dots, W_{ri}$) using Ordinary Least Squares (OLS). The predicted values are computed from this regression. Call these $\dot{X}_{1i}$.

2). Second-stage regression(s): Regress Y_i on the predicted values of the endogenous variable X_{1i} and the included exogenous variables $(W_{1i}, \dots, W_{ri})$ using OLS. The TSLS estimators $\dot{\beta}_0^{TSLS}, \dots, \dot{\beta}_{k+r}^{TSLS}$ are the estimators from the second- stage regression. The TSLS is estimated as follows:

$$\dot{\beta}_1^{TSLS} = \frac{S_{XY}}{S_{ZX}} = \frac{\sum_{i=1}^{n}(Z_i - \bar{Z})(Y_i - \bar{Y})}{\sum_{I=1}^{n}(Z_i - \bar{Z})(X_i - \bar{X})}$$

The most efficient way to combine multiple instruments is usually the TSLS originally developed by Theil (1953) and later used by (Imbens and Angrist(1994); Card (1995); Heckman (1998)). The coefficients are over-identified if there are more instruments than endogenous regressors (m>k); they are under-identified if m<k; and they are exactly identified if m=k. Estimation of the

IV regression requires exact identification or over-identification. To ensure this requires a test referred to as the Sargan's overidentification Test (the J-Statistic).

Let $\dot{u}_i^{TSLS}$ be the residuals from TSLS estimation of equation (1.1). OLS is used to estimate the regression coefficients in equation (1.2) below;

$$\dot{u}_i^{TSLS} = \delta_0 + \delta_1 Z_{1i} + \cdots + \delta_m Z_{mi} + \delta_{m+1} W_{1i} + \cdots + \delta_{m+r} W_{ri} + e_i \qquad (1.2)$$

Where e_i is the regression error term. Let F denote the homoskedasticity-only F-statistic using the hypothesis that $\delta_0 = \delta_1 = \cdots \delta_m = 0$. The overidentifying restrictions test statistic is $J = mF$. Under the null hypothesis that all the instruments are exogenous, then in large samples J is distributed as χ^2_{m-k}, where m-k is the 'degree of overidentification', that is the number of instruments minus the number of endogenous regressors.

The instruments are considered weak if the first stage F-statistic is the F-statistic testing the hypothesis on the instruments $(Z_{1i}, \ldots, Z_{mi})$ equal zero in the first stage of the Two-Stage Least squares. When there is a single endogenous regressor, a first-stage F less than 10 indicates that the instruments are weak, in which case the TSLS estimator is biased (even in large samples), and TSLS t-statistics and confidence intervals are unreliable. Analysis of the data and the estimation of the IV regression model in (1.1) was carried out using the STATA software because it combines the two steps (First-stage and Second-Stage regression) into one step and the output is given in one step. This model is used to show how the number of days spent sick or looking after a sick person affects percapita household agricultural income by showing that the number of days spent sick or looking after a sick person is an endogenous variable which depends on the distance to the health center, access to clean water and the information on sanitation within the household.

4.3 Expected signs

The table below shows the expected signs from the instrumental Variable model both the first stage and second stage models

Table 4.1: Table of expected signs

First Stage Regression		Second Stage Regression	
laborloss	Expected Signs	percpincome	Expected Signs
hhage2	-	laborloss	-
hhsex		hhage2	-
hhage	-	hhsex	-
hhedu	-	hhage	+
flabor	+	hhedu	+
mlabor	-	flabor	-
areaplanted		mlabor	+
infowaterp~p	-	areaplanted	+
Distapwtr	-		

4.4 Explanation of the expected signs in the first stage regression

Information on water preparation (*infowaterp~p*) in the model is a prevention mechanism. The more information a farmer has on water preparation the more he is able to prevent diseases and therefore reduce on the number of days spent sick and hence more time is available for farm work and therefore more production which results into increased agricultural percapita income. We expect this variable to have a negative sign in the first stage regression.

We expect the number of adult male labour (*mlabor)* to have a negative sign in the first stage regression model. This is because the more male labour force available to the household the fewer the number of days lost without attending to farm activities. This is because in Tigray Region males in the household are looked at as the source of farm labour and a big percentage of farm work such as tilling of land is done by the male work force and therefore a negative sign is expected with adult male labour force while the opposite sign is expected with the number of females (*flabour)*) because females are not allowed to cultivate land due to cultural prohibitions.

Sex of household head (*hhsex*) is expected to have no effect on the laborloss (number of days spent sick or looking after a sick person). This is because due to cultural prohibitions regarding women participation in farming in Tigray, they prefer renting out their land. This is why it is left as a blank space in the first stage Regression table.

Head of Household age (*hhage*) is expected to have a negative sign and (*hhage2*) is expected to have a negative sign in the model because participation in farm activities reduces as one gets older and this reduces percapita crop income (concavity effect of age). This is because as one gets older then the children take up most of the responsibilities such as taking care of the land and therefore likely to reduce the number of days spent without working. This is expected in the first stage regression.

Distance to health center (*disthealth*) and access to clean water (*distprwtr*) are expected to have negative sign. This is because they affect percapita income through the variable laborloss. The shorter the distance to the health center and the better the access to clean water, the fewer the number of days spent sick or looking after a sick person. This effect is expected in the first Stage Regression.

Area planted (areaplanted) is expected to have no effect on the number of days spent sick or looking after a sick person.

4.5 Explanation of the expected signs in the Second Stage Regression

Head of household education (*hhedu*) is expected to have a positive effect on percapita income. The more education a household head has the easier it is to access better farm technologies and hence able to boost farm production which translates into increased percapita crop income. This effect is expected in the second stage regression.

Laborloss (the number of days spent sick or looking after a sick person) is expected to have a negative sign from the regression model. The more the number of days spent sick, the less the attention given to farm activities and this reduces production and hence agricultural percapita income. This result is expected in the second stage regression of the model.

Head of the Household sex (hhsex) is expected to affect percapita crop income positively. This is because of the farm activities are done by the males.
Due to cultural prohibitions female headed households do not participate in farm activities and they prefer renting out their land and in most cases to land lords where they have crop and output sharing arrangements and therefore their percapita crop income is likely to be affected positively.

The square of Head of Household age (hhage2) is expected to have a negative effect on percapita crop income. This is due to the concavity effect of age. The older one gets the less the participation in farm activities. Once participation in farm activities reduces, then percapita crop income also reduces. This effect is expected in the Second Stage Regression.

Adult female labour (flabour) is expected to have a negative effect on percapita crop income. Due to cultural prohibitions in Tigray females are not allowed to participate in farm activities. Since the participation is limited they are expected to affect percapita crop income negatively because the more females they are the more the consumption which reduces percapita crop income.

Adult male labour (mlabour) is expected to have a positive effect on percapita crop income. Most of the farm activities in Tigray are done by male labour force. Therefore the more adult labour a household has the more likely it is to increase production.

Area planted (areaplanted) is expected to have a positive effect on percapita crop income. This is because the larger the area planted, the more the crop output is expected and the higher the percapita crop income.

Chapter five

Results and discussions

5.1 Analysis of econometric results

To analyze the effects of the variables discussed in the previous section the Instrumental Variable (IV) Regression model was used. The model results are presented in the appendix section in Table A1. Ordinary Least Squares (OLS) was not used after the testing for endogeneity and the Hausman -Wu test confirmed presence of endogeneity. This is because in presence of endogeneity Ordinary Least Squares (OLS) becomes inconsistent and the parameter estimates are biased. Plot size was included in the instrumental Variable (IV) model to control for plot level characteristics.

The Instrumental Variable Regression (IV) model shows that it is non-linear functional form because of the inclusion of the square of the variable *hhage2* (head of household age squared) to allow for concavity of age effects (Croppenstedt and Muller, (2000)). The test for omitted variables confirmed this. The variables thought to be endogenous were not included in the model except the one of special interest-the number of days spent sick or looking after a sick person.
The first stage regression model results showed that distance to the health center, access to clean water, information on water preparation and area planted are significant at 10 % level of significance. This means that they have an effect on the number of days spent sick or looking after a sick person. However, head of household age squared, head of household sex, head of household age, head of household education, adult male labour and adult female labour were found to be insignificant and this implies that they do not have an effect on the number of days spent sick or looking after a sick person.

The first stage regression model results also show that the number of days spent sick or looking after a sick person is an endogenous variable and depends on the distance to the health center, access to clean water and information on water preparation.

Table 5.1: Instrumental Variable Regression Model of variables in the first stage

Number of days spent sick	First Stage Model
Head of household age squared	-0.0055918
	(-0.0054083)
Head of Household Sex	1.03496
	(-1.4468)
Head of Household age	0.529532
	(-0.570523)
Head of Household education	0.3165358
	(-0.47429)
Adult female labour	0.7446071
	(-0.7548)
Adult male labour	-0.135668
	(-0.8598)
Area planted	0.3441691*
	(-0.1919)
Information on water preparation	5.894993****
	(-0.924)
Distance to health center	0.0882057***
	(-0.0478)
Access to clean water	-0.11324***
	(-0.0421)
constant	-16.39815
	(-13.77)

Significance levels: *indicates p<0.10, **indicates p<0.05, ***indicates p<0.01, ****indicates p<0.0001. cluster robust standard errors

Access to clean water and distance to the health center are both significant at the 5% level of significance. As hypothesis 2 states we expected a positive sign for both variables but distance to the health center has a positive sign and the access to clean water has a negative sign. They

do not affect percapita crop income directly, but they do indirectly through the variable number of days spent sick or looking after a sick person).

Distance to the health center in comparison with number of days spent sick has got a positive sign. This is in line with the hypothesis number 2. The shorter the distance to the health center the easier it is for households to access medical facilities such as drugs and medical personnel and hence more likely to reduce the number of days spent sick or looking after a sick person.

Access to clean water has got a negative sign, meaning that the more access a household has to clean water, the fewer the number of days spent sick.

Information on water preparation was found to be significant at the 5% level of significance. However, according to the researcher this variable does not explain number of days spent sick or looking after a sick person but all it does show is the correlation between information on water preparation and number of days spent sick. The model showed the relationship to be positive, implying that households that had more number of days spent sick or looking after a sick person are given more information on water preparation. This implies that we cannot conclude the effect in hypothesis number 3 based on the information from the model. As the data showed, the health extension agents on average visited the household 11 times prior to the survey. The researcher ensured that the model is robust by adding the force robust command in stata; **vce (robust)** to the model.

Area planted was found to be significant at 10 % level of significance in the first stage regression model and has got a positive sign. The possible explanation is that if the household cultivates a bigger area of land the more time is needed to attend to farm activities and the more it is likely to suffer from diseases caused from exhaustion and fatigue.

Table 5.2: Instrumental Variable Regression Model of variables in the second stage

Explanatory variables	Second Stage Regression Model
Number of days spent sick	-39.288**
	(-16.085)
Head of Household Age squared	0.635
	(-0.423)
Head of household sex	-299.439***
	(-75.857)
Head of Household age	-53.483
	(-42.743)
Head of Household education	-89.609**
	(-30.529)
Adult female labour	190.044**
	(-77.664)
Adult male labour	48.798
	(-60.593)
Area planted	-19.036
	(-20.294)
Constant	2102.786**
	(-989.858)
chi2	41.691***
R-squared	0.119
Number of observations	199

Significance levels: * indicates p<0.10, **indicates p<0.05, ***indicates p<0.01, ****indicates p<0.0001.

The model results shows that the number of days spent sick or looking after a sick person affects percapita crop income negatively which is in line with hypothesis 1 which states that the more the number of days spent sick the less the percapita crop income to the household. According to the model results from the second stage regression, one more day spent sick reduces percapita crop income by approximately 39 Ethiopian Birr.

5.2 Testing for weak instruments

From the model presented, we tested for weak instruments and the results are presented in table A2 in the appendix section. This involved testing for joint significance of the instruments and the results showed that I have very strong instruments because the F- value = 21.45 is greater than 10, the rule of thumb value for strong instruments. Therefore distance to health center, access to clean/safe water and information on water preparation are very strong instruments for number of days spent sick or looking after a sick person.

5.3 Testing for endogeneity among the variables

From the model, since we are able to find strong instruments, the next argument is that did we really need to use Instrumental Variables (IV) and is the number of days spent sick or looking after a sick person an endogenous variable? The answer is that the test for endogeneity presented in table A3 in appendix section revealed that there is endogeneity at 10% level of significance in the model and it is justifiable to use Instrumental Variable (IV) Regression model.

5.4 Testing for overidentifying restrictions

The test for overidentification restriction was used to find out if we have more instruments than required to estimate the parameter estimates. From the result in table A4 in the appendix section we failed to reject the hypothesis of no overidentification restrictions at 5% level of significance.

In summary, we are able to find the instruments for the number of days spent sick as the distance to the health center, access to clean/safe water and information on water preparation because all the tests (for endogeneity and overidentification restrictions) were satisfied.

Chapter six

Conclusions

In this thesis paper we provide empirical support for the link between health status and agricultural percapita crop income in Tigray Region, Northern Ethiopia.

The model results show that access to clean/safe water and number of days spent sick or looking after the sick person in the household affect agricultural percapita crop income. However, the researcher could not conclude on the number of days spent sick.

Model results showed that number of days lost to sickness or spent looking after a sick person is an endogenous variable which depends on the distance to the health center, access to clean/safe water and information on water preparation and the test for weak instruments showed that they are very strong instruments since the F-value was greater than the rule of thumb 10. This implies that in looking for the effect of the number of days on percapita agricultural household income we cannot simply use OLS (Ordinary Least Squares Regression); the results will be biased and inconsistent because of the presence of endogeneity.

The results show a large scope for reduction in number of days spent sick or looking after a sick person through improved access to the health center and access to clean and safe water.

The model results also show that the number of days spent sick or looking after a sick person affects percapita crop income negatively which is the evidence drawn from Tigray, Northern Ethiopia.

In conclusion, there is strong evidence from Tigray Region, Northern Ethiopia that health status affects agricultural percapita crop income of farm based households and if the government would like to help its people in as far as increasing percapita crop income at household level then increasing access to clean/safe water and access to health facilities such as hospitals, clinics and dispensaries would go in a direction of reducing the number of days spent or looking

after a sick person and more time dedicated to farm activities. This would in turn increase per-capita income at household level.

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APPENDIX 1

Table A1: The Instrumental Variable (IV) regression model

First-stage regressions

Number of obs	199
F(10, 188)	10.62
Prob > F	0.0000
R-squared	0.1727
Adj R-squared	0.1287
Root MSE	8.0289

laborloss	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
hhage2	-.0055918	.0054083	-1.03	0.303	-.0162606	.005077
hhsex	1.03496	1.446766	0.72	0.475	-1.819021	3.888942
hhage	.529532	.5705229	0.93	0.355	-.5959173	1.654981
hhedu	.3165358	.4742891	0.67	0.505	-.6190765	1.252148
flabor	.7446071	.7548312	0.99	0.325	-.7444202	2.233635
mlabor	-.135668	.8597716	-0.16	0.875	-1.831707	1.560371
areaplanted	.3441691	.1918764	1.79	0.074	-.0343382	.7226765
infowaterp~p	5.894993	.9244347	6.38	0.000	4.071395	7.71859
disthealth	.0882057	.0477489	1.85	0.066	-.0059869	.1823982
distapwtr	-.113246	.0421219	-2.69	0.008	-.1963384	-.0301536
_cons	-16.39815	13.7712	-1.19	0.235	-43.56409	10.76778

Instrumental variables (2SLS) regression

Number of obs	199
Wald chi2(8)	41.69
Prob > chi2	0.0000
R-squared	0.1186
Root MSE	647.57

percpincome	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
laborloss	-39.28786	16.08506	-2.44	0.015	-70.814	-7.761731
hhage2	.6351953	.422512	1.50	0.133	-.1929129	1.463304
hhsex	-299.4387	75.8572	-3.95	0.000	-448.116	-150.7613
hhage	-53.48314	42.74294	-1.25	0.211	-137.2578	30.29149
hhedu	-89.609	30.52939	-2.94	0.003	-149.4455	-29.77249
flabor	190.0437	77.66385	2.45	0.014	37.82532	342.262
mlabor	48.79761	60.59279	0.81	0.421	-69.96207	167.5573
areaplanted	-19.03602	20.29361	-0.94	0.348	-58.81077	20.73872
_cons	2102.786	989.8576	2.12	0.034	162.701	4042.872

Instrumented: laborloss
Instruments: hhage2 hhsex hhage hhedu flabor mlabor areaplanted infowaterprep disthealth distapwtr

Table A2: Testing for weak instruments

Instrumental variables (2SLS) regression

Number of obs = 199
F(10, 188) = 10.62
Prob > F = 0.0000
R-squared = 0.1727
Adj R-squared = 0.1287
Root MSE = 8.0289

laborloss	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
hhage2	-.0055918	.0054083	-1.03	0.303	-.0162606	.005077
hhsex	1.03496	1.446766	0.72	0.475	-1.819021	3.888942
hhage	.529532	.5705229	0.93	0.355	-.5959173	1.654981
hhedu	.3165358	.4742891	0.67	0.505	-.6190765	1.252148
flabor	.7446071	.7548312	0.99	0.325	-.7444202	2.233635
mlabor	-.135668	.8597716	-0.16	0.875	-1.831707	1.560371
areaplanted	.3441691	.1918764	1.79	0.074	-.0343382	.7226765
infowaterp~p	5.894993	.9244347	6.38	0.000	4.071395	7.71859
disthealth	.0882057	.0477489	1.85	0.066	-.0059869	.1823982
distapwtr	-.113246	.0421219	-2.69	0.008	-.1963384	-.0301536
_cons	-16.39815	13.7712	-1.19	0.235	-43.56409	10.76778

(no endogenous regressors)

(1) infowaterprep = 0
(2) disthealth = 0
(3) distapwtr = 0

F(3, 188) = 15.24
Prob > F = 0.0000

First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	Robust F(3,188)	Prob > F
laborloss	0.1727	0.1287	0.1316	15.2404	0.0000

Table A3: Testing for endogeneity

```
Tests of endogeneity
Ho: variables are exogenous

Robust score chi2(1)          =  5.14327  (p = 0.0233)
Robust regression F(1,189)    =   5.7708  (p = 0.0173)
```

Table A4: Testing for overidentification restrictions

```
Test of overidentifying restrictions:

Score chi2(2)          =  .286637  (p = 0.8665)
```

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IN COLLABORATION WITH MEKELLE UNIVERSITY

HOUSEHOLD QUESTIONNAIRE

The information collected will be used for research purposes. It will be treated as confidential and will not be used by tax authorities or others to assess the need for food aid or other assistance.

Zone _____

Woreda _____

Tabia _____

Kushet _____

Household ID _____

Name of household head

Distance to woreda town (walking minutes)	
Distance to local market (walking minutes)	
Distance to primary school (walking minutes)	
Distance to secondary school (walking minutes)	
Distance to all weather road (walking minutes)	
Distance to transporatation service (walking minutes)	
Distance to health center (walking minutes)	
Distance to grain mill	
Distance to nursery site	
Distance to protected water source(walking minutes)	
Distance to tap water(walking minutes)	

Enumerators:	Dates interviewed
First interview:	
Second interview:	
Third interview:	

Data checked by	When	Status	Comments

Distance to tap water(walking minutes)	

Enumerators:	**Dates interviewed**
First interview:	
Second interview:	
Third interview:	

Data checked by	**When**	**Status**			**Comments**
		ok	**Correct**	**Return**	

Data punched	**When**	**Who**	**Comments**
Pages			
Pages			
Pages			
Pages			

Farm household survey: Household characteristics **Page 1**

Woreda:		Interviewer:		Household number:	
Tabia		Date of interview:			
Kushet		Household head name:			
Household composition in 2002 (E.C.)					
Household members		Religion:			

MNo:	Name	relationship	Sex	Age	Education	Skills	Occupation	Presence
1		Head						
2								
3								
4								

5								
6								
7								
8								
9								
10								
11								
12								
13								

Codes: Relation to household head: 1=wife, 2=child, 3=grand child, 4=brother, 5=sister, 6=hired labour
7=other, specify:
Sex: 1=female, 2=male. Age: Years. Skills: specify
Education: 0=illeterate, 1=read and write, 2= elementary, 3= church education, 4= secondary, 5=other, specify.
Occupation: 0=dependent, 1= student (in school), 2=watch after animals, 3=housewife, 4= farming
5=hired labourer, 6=off-farm activity, 7=Tabia/kushet official: PA/village official:specify
Presence: Months staying in the household during last 12 months

Do any of the household members live outside the village this year (EC 1995)?

Yes	No

Name	Place	Purpose	Since when	Coming back when

HOUSEHOLD NAME:_____ HH id:_____

Farm household survey: Household Expenditures **Page 2**

Expenditure on farm inputs EC 1994-95

Item	Quantity	Own prod.		Purchased	Price	Unit	Tot. Expend.	Where boug	source of cash
Seed, teff									
Seed, wheat									
Seed,maize									
Seed, barley									
Seed, sorghum									
Seed, chickpea									
Seed, Millet									
Seed, Fava bean									
Seed, pea									
Seed, Latyrus									
Seed, others									
Seed, vegetables									
Seed, Pepper									
Other tree seedl.									
Fertilizer: Urea									
Fertilizer: DAP									
Herbicide									
Pesticide									
Tools/equipment									
Manure									
Hired oxen									
Animal salt									
Animal medicine									
Animals bought									

Animal feed:									
Grass									
crop residue (hay stover, etc.)									

Unit: 1) kg; 2) Shember; 3)Minilik; 4) mishe; 5)others. Specify

Where bought: 1: from neighbour, 2: within kushet, 3: local market, 4: woreda market, 5: trader visiting village

Source of cash: 1: ownsavings, 2:formal credit, 3:informal credit,4:sale of own production, 5:sale of assets,6: other specify.

Have you obtained credit to pay for farm inputs or for farm investments? 1) YES, 0) NO. A69 If yes, give details for the 3 last years:

Source	Year	Purpose	Amount	Repayment conditions			
				Frequency	Duration	Interest	completed

Have you over the last 3 years received credit for			Amount	Source	Year
Nonagricultural investments	Yes	No			
Consumption loans	Yes	No			
Family events	Yes	No			
Other, specify	Yes	No			
	Yes	No			

If you want, are you able to obtain credit for

Purpose	Yes/No	Source	Max amou	Interest rat	Duration	Comment	
a. Investment							
in farm inputs							
in oxen purchase							
in other business							
b. Consumption							
c. Family events							

If you have already received credit for some purpose, are you able to obtain more loans before paying back what you have already obtained? Yes\no

Are you member of a credit association?	Yes=1	No=0		
If yes, do you prefer to get credit on individual basis?			Yes=1	No=0
Has any member in your credit group defaulted?		Yes=1	No=0	
If yes, what were the consequences?				

Does any one in the HH save/put money in	1=Yes	How much?	
any of the following?	0=No	Current	One year ago
DECSI			
Equb			
Edir			
Nearby Bank			
At home			
Others,specify			

HOUSEHOLD NAME:_____ HH id:_____ **Page 3**

Farm household survey: Household Consumption Expenditures (last year)

Commodity	Quantity			Quantity	Where	Per	Price	Unit	Own prod	Cash Consu	Total Value of
	Own Prod	Free food	FFW	Bought	bought		Birr		Cons.Valu	Expenditur	Consumption
Teff											
Wheat											
Barley											
Maize											
Sorghum											
Millet											
Faba Bean											
Latyrus											
Chick Pea											
Pea											
Linseed											
Lentile											
other, specify											
Fruites											
Banana											
Mango											
Papaya											
Avocado											
Guava											

Vegetables											
Pepper											
Cabbage											
Onion											
Potato											
Tomato											
Other vegetables											
Garlic											
Coffee											
Spices											

Quantity: Number of units. Per: 1:week, 2:month, 3:season,4: year.

Unit: 1:Kg, 2:pieces, 3:sheets,4:litre, 5:bags, 6:bundles 7:others, specify etc.

Total expenditure: Includes value of own production. Cash expenditure: On purchased quantity

Own production: Market value (Birr) of own production.

Where bought: 1: from neighbour, 2: within Tabia 3: local market, 4: distant market, 5: trader visiting village

HOUSEHOLD NAME:_____ HH id:_____ **Page 4**

Farm household survey: Household Consumption Expenditures (continued)

Commodity	Quantity			Quantity	Where	Per	Price	Unit	Own prod	Cash Consu	Total Value of
	Own Prod	Free food	FFW	Bought	bought		Birr		Cons.Valu	Expenditur	Consumption
Beef											
Sheep											
Goat											
Chicken											
Eggs											
Milk											
Butter											

Sugar											
Cooking oil											
Salt											
Tea											
Clothing											
Shoes											
Blanket/bedsheet											
Umbrella											
Soap/Wash.p.											
Fuelwood											
Kerosene											
Batteries											
Mobile phone											
Radio											
Corrugated iron											
Furniture											
Travel/Transport											
School fees											
School books etc.											
Health/Medicine											
Income tax											
Land tax											
Religious contribution											
Ceremonies											
Jewelry											
House rent											

House construction											
Cigarettes/Tobacco											
Electricity											
Wood materials											
Leisure (drinks, candies, lotteries etc.)											
Other											

Quantity: Number of units. Per: 1:week, 2:month, 3: season ,4: year.

Unit: 1:Kg, 2:pieces, 3:sheets,4:litre, 5:bags, 6:bundles 7:others, specify etc.

Total expenditure: Includes value of own production. Cash expenditure: On purchased quantity

Own production: Market value (Birr) of own production.

Where bought: 1: from neighbour, 2: within Tabia 3: local market, 4: distant market, 5: trader visiting village

HOUSEHOLD NAME:_____ HH id:_____ **Page 5**

Farm household survey: Crop Selling Activities

Crop	**Kushet**				**Local market**					**Woreda market:**				
	Quantity	Price/uni	Month so	Income	Quantit	Price/uni	Where?	Month s	Income	Quantit	Price/un	Where?	Month	Income
Teff														
Wheat														
Barley														
Maize														
Sorghum														
Millet														
Oats														
Faba Bean														
Latyrus														
Chick pea														

Lentile														
Linseed														
Pea														
Pepper														
Potato														
Tomato														
Banana														
Mango														
Papaya														
Avocado														
Guava														
Pepper														
Cabbage														
Onion														
Carrot														
Tomato														
Garlic														
Coffee														
Eucalyptus														

Means of transport to the different markets:	Local market:	Distant market:
Frequency of visit to the different marke (Per month)	Local market:	Distant market:
Time required to travel one way to/from each m (walking minutes)	Local market:	Distant market:

HOUSEHOLD NAME:_____ HH id:_____ **Page 6**

Farm household survey: Livestock Production Activities

Animal type	**Stock** 2 years ago	Stock 1 year ago	Stock Current	Born during EC 2001/02	Died during EC 2001/02	Slaughtered EC 2001/02	Bought EC 2001/02	Sold during EC 2001/02	Months in milking (2001/02)	Milk per day (EC2001
Cattle										
Milking cow										
Other cows										
Oxen										
Heifer										
Bulls										
Calves										
Sheep										
Goats										
Horses										
Mules										
Donkeys										
Camel										
Chicken										
Bee hives										

Source of cash to buy the livestock

1	Sale of output		Other
2	Remittance		
3	Credit		
4	Sale of food from FFW		
5	Sale of other livestock		

HOUSEHOLD NAME:_____ HH id:_____

Farm household survey: Livestock Selling Activities EC 2001-02

Animal/	Village				Local Market					Distant market			
Product	Quantity	Price/unit	When sold	Income	Quantity	Price/unit	Where	When sold	Income	Quantity	Price/unit	Where	Wh
Cattle													
Milking cow													
Other cows													
Oxen													
Heifer													
Bulls													
Calves													
Sheep													
Goats													
Horses													
Mules													
Donkeys													
Chicken													
Butter													
Milk													
Meat													
Eggs													
Skins													
Animal dung													
Honey/Wax													

Reasons for selling livestock last year?

1	To cover food expense
2	To cover clothing and schooling expenses
3	For wedding and other social expenses
4	To cover land tax
5	Others. Specify

HOUSEHOLD NAME:_____ HH id:_____ **Page 8**

Farm household survey: Other Sources of Income 2001 -02 E.C)

Source	Input quantity	Input costs	Who earned	Where/to whom	When/Period	Quantity	Price/ Wage	Income	Years of Experience
Hiring out oxen									
Hire out labour									
Labour exchange									
Assistance received									
Assistance given									
Rent out land									
Employment									
Cash support									
Migrant income									
Remittance Income									
Assistance from relatives									
Government Transfers									
Gifts									
Sale of firewood									
Sale of Handicraft									
Sale of beverages									
Petty trade									
Grain mill									
Other business/services									

Source	Number of months/yr worked	how many person in the hh	Who earned (hh member id)	Input quantity (toal labor mandays)	Outoput Quantity (food in kg or days of work) per year		price/wage (price of wheat per kg or daily payment rate of CFW		Total income	Quantity food so
					unit	quantity	unit	price		
Food for Work										
Food Aid										
Cash for Work										
OFSP(Other Food Security Program)										

Employment: permanent job locally, Hire out labour: temporary job locally, Migrant income: temporary job outside community member by household Remittance income: Money sent by relatives permanently living elsewhere

What durable commodities and implements does the household have?

Household Assets	Number now	Year bough Latest	Number bought last year	Price	Current valu	Need replacement (# of years)	Implements Owned 1998 EC	Source of cash
Farm inplements								
Plough								
Donkeycart/horsecart								
Plough parts								
Hoe								
Sickle								
Hammer								

Ax								
Spade								
Wheelbarrow								
Other production assets:								
Irrigation equipment								
Irrigation well								
Irrigation pump								
Pond								
Assets								
Furniture								
Radio/cassetplayer								
Wrestwatch								
Bicycle								
Stove								
House with iron roof								
Hut								
Kitchen house								
toilet*								
Jewelry								
Mobile phone								

Source of cash: 1:Sale of output, 2:Remittances, 3:Credit, 4:Sale of food from FFW, 5:Sale of livestock, 6:Savings, 7:Others, specify

*Whether the household has toilet or not should be verified by the interviwer

HOUSEHOLD NAME:_____ HH id:_____ **Page 9**

Farm household survey: Preferences and Perceptions

Time preferences:

If you have the choice between receiving 1000 Birr one year into the future (with certainty) and another amount today, how large would that amount today have to be for you to prefer that amount today or prefer to wait for the 1000 Birr in a year?

Husband Where start?	Amount today, Birr	Prefer today Tick	Amount in one year	Prefer 1000 Birr in one year
	20		1000	
	50		1000	
	100		1000	
	150		1000	
	200		1000	
	250		1000	
	300		1000	
	350		1000	
	400		1000	
	450		1000	
	500		1000	
	550		1000	
	600		1000	
	650		1000	
	700		1000	
	750		1000	
	800		1000	
	850		1000	
	900		1000	
	950		1000	
	1000		1000	

Wife Where start?	Amount today, Birr	Prefer today Tick	Amount in one year	Prefer 1000 Birr in one year
	20		1000	
	50		1000	
	100		1000	
	150		1000	
	200		1000	
	250		1000	
	300		1000	
	350		1000	
	400		1000	
	450		1000	
	500		1000	
	550		1000	
	600		1000	
	650		1000	
	700		1000	
	750		1000	
	800		1000	
	850		1000	
	900		1000	
	950		1000	
	1000		1000	

If you received 500 Birr today, what would you use the money for?

Tick		Budget	Husband	Budget	Wife
a	Consumption, What?				
b	Investment, What?				
c	Savings, for What?				
d	Pay back credit				
e	Other, specify				

If you received 1000 Birr today, what would you use the money for?

Do you expect next year's income to be than the EC 2001-02 year income?

Higher	
The Same	
Lower	

If higher/lower, how much higher/lower?

0-25%	
25-50%	
50-75%	
>75%	

Are you willing to invest in something this year if it takes three or more years till you get the benefits of the investment?

Yes
No

Are you willing to invest in something this year if it takes five or more years till you get the benefits of the investment?

Yes
No

Are you willing to invest in something this year if it takes ten or more years till you get the benefits of the investment?

Yes
No

HOUSEHOLD NAME:_____ HH id:_____ **Page 10**

Farm household survey: Preferences and Perceptions

If you have the choice between a crop which gives 20 qtl in a good year but no yield in a bad year, and a crop which gives 19.5 qtl in a good year and 2 qtl in a bad year, which crop would you prefer to plant?
We assume a bad year occurs one out of 5 years (2 out of 10 years are bad)

Husband

	Good year	Bad year	Choice
Crop 1	20	0	1
Crop 2	19.5	2	2

If choice 2

	Good year	Bad year	Choice
Crop 2	19.5	2	1
Crop 3	18	4	2

If choice 2

	Good year	Bad year	Choice
Crop 3	18	4	1
Crop 4	16	6	2

If choice 2

	Good year	Bad year	Choice
Crop 4	16	6	1
Crop 5	13	8	2

If choice 2

	Good year	Bad year	Choice
Crop 5	13	8	1
Crop 6	9	9	2

Wife

	Good year	Bad year	Choice
Crop 1	20	0	1
Crop 2	19.5	2	2

If choice 2

	Good year	Bad year	Choice
Crop 2	19.5	2	1
Crop 3	18	4	2

If choice 2

	Good year	Bad year	Choice
Crop 3	18	4	1
Crop 4	16	6	2

If choice 2

	Good year	Bad year	Choice
Crop 4	16	6	1
Crop 5	13	8	2

If choice 2

	Good year	Bad year	Choice
Crop 5	13	8	1
Crop 6	9	9	2

Is there any changes in your strategy to cope with food insecurity as compared to 8-10 years ago? Yes / No
If yes, explain why/how:

How strong is your social network (extended family) in terms of providing help in case you face serious problems (e.g. drought, sickness, income failure)? Very Strong / Medium

Is there any changes in your strategy to cope with food insecurity as compared to 8-10 years ago?	Yes
If yes, explain why/how:	No

How strong is your social network (extended family) in terms of providing help in case	Very Strong
you face serious problems (e.g. drought, sickness, income failure)?	Medium
Explain:	Weak

HOUSEHOLD NAME:_____ HH id:_____

Farm household survey: Food security and Coping strategies

What were your priority in responses (coping strategies) when you faced drought?

Activity	Response to income fluctuations (Rank=Priority 1)
Rely on existing off-farm income sources	
Borrow money from relatives	
Borrow money from other sources	
Use cash/bank savings	
Sell animals	
Sell trees	
Obtain food through Food-for-Work	
Obtain cash through Cash-for-Work	
Withdraw children from school	
Search for employment elsewhere in Ethiopia	

Assistance from relatives	
Reduce expenditure on clothing	
Reduce expenditure on:	
Other, specify:	

Is there any changes in your strategy to cope with food insecurity as compared to 8-10 years ago?
If yes, explain why/how:

How strong is your social network (extended family) in terms of providing help in case you face serious problems (e.g. drought, sickness, income failure)?
Explain:

Mekelle University

In collaboration with

Norwegian University of Life Sciences

NOMA DNRE Survey 2010, Tigray, Ethiopia

Household Health Questionnaire: Malaria Section

Name of Enumerator----------

Name of Household Head----------Sex---------

Name of person interviewed----------Sex---------

Date----------

Household Location

Zone----------

Woreda----------

Tabia----------

Kushet----------

Household No----------

101. Have you ever seen or heard malaria educational messages from any source? 1. Yes 2. No **→Q.104**	**102.** From which source was the information? (Circle all which apply) 1. Radio 2. Newspaper /magazine 3. Posters/notices 4. Friends 5. Parents 6. Health workers 7. Gov't official 8. hurch/mosque 9. School 10.Others (specify)	**103.** What messages(s) did you see or hear? Circle all which apply 1. About prevention 2. About treatment 3. About transmission 4. Other (specify) 5. Can't remember	**104.** Do you think malaria can kill a person? 1. Yes 2. No	**105.** Are you aware of any way(s) to prevent malaria? 1. Yes 2. No **→Q.107**

106. What is the best way to prevent yourself /family members from malaria (Agoba)? One answer only	**107.** Do mosquitoes cause any trouble to your household?	**108.** Are you currently using any method (whether commercial or traditional) to protect your household from mosquitoes?	**109.** Why don't you protect your household from mosquitoes?	**110.** Methods used to prevent mosquitoes by your household? All which apply
1. Sleeping under bed-nets 2. Avoid being bitten by Mosquitoes 3. Prophylaxis 4 Use of coils 5. Avoiding cold 6. Avoid being too long On the sun 7. Drinking clean water 8. Keep household surrounding clean 9. Closing windows at night 10. Others 11. Nothing → **107** 99. DK	1. Yes 2. No	1. Yes→**Q.110** 2. No	1. I don't have money 2. I don't have time 3. Protective materials are not available here 4. I can't be bothered 5. Gov't's duty 6. Others (specify) 99. DK	1. Bed-nets 2. Insecticide sprays 3. Clearing areas around 4. Closing windows/ doors at night 5. Lighting fire in the house 6. Using coils 7. Apply mosquito repellents on skin 8. Use traditional plants 9. Use cowdung

				10. Other traditional Methods (specify) 11. Other commercial methods (specify)

Household Member (Name) From Head to youngest person	**111.** Has …… ever been attacked by malaria? 1. Yes 2. No **→Go to Next person**	**112.** When was the last malarial attack? 1. 1 week ago 2. 1 Month ago 3. 2 months ago 4. 1 year ago 5. Others 99. DK	**113.** Where did s/he get treatment? 1. Pharmacy 2. Drug shop 3. General merchandise 4. Tradition healer 5. Public hospital/PHC 6. Private Hospital/clinic 7. Community trained attendant 8. Did not treat (remove s/he from Q.117; then next person)	**114.** Time taken to walk to the source of treatment s/he attended (minutes)	**115.** What treatment (s) did s/he receive? (check medical form) Circle all which apply 1. Traditional medicine 2. Nivaquine 3. Chloroquine 4. Fansidar 5. Quinine 6. Mephaquine 7. Coartem 8. Aspirin 9. Other (specify) 99. DK	**116.** Total amount spent for treating the last malarial episode in Birrs (Transport, medical fees, drugs and unplanned dietary change)	**117.** Frequency of malaria attack within the last 12 months (No of attacks)	**118.** Number of days did not work because suffered from malaria or nursed malaria patient	**119.** Frequency of malaria attack within the last 3 months (number of attacks)
1	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				

2	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
3	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
4	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
5	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
6	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
7	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
8	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
9	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
10	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
11	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
12	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				
13	1 2	1 2 3 4 5 99	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9 99				

201.	**202.**	**203.**	**204.**	**205.**
What was the total cost for the household during last year for use of the following preventive measures against malaria?	Total cost for malaria treatment during last year	Think about the meth-ods to protect against	What type is the nearest	How far is it from your

Bed-nets Birr:	Insecticides Birr	Coils Birr	Repellents Birr	Drugs Birr	Travel and other expenses, Birr	mosquitoes Q.207 above. Which one is most suitable for your household? 1. Bed-nets 2. Insecticide sprays 3. Cleaning areas around 4. Closing windows/doors at night 5. Lighting fire in the house 6. Using coils 7. Mosquito repellents 9. Use cow dung	mosquito breeding place? 1. Swamp 2. Irrigation field 3. Forest 4. Pond 5. Irrigation dam 6. Others 99. DK	homestead to the near-est mos-quito breed-ing place (one way walk in min-utes)? ……

Section 3: Bed-nets: Section A. Ask Q.302 –HCB6 only to Households who currently use bed-nets

301. How many bed nets does the household have? Number:_____ If 0 →**Section B**	**302.** When ob-tained/bought? Year(EC) Net 1 Net 2 Net 3	**303. Source (s) of bed-nets** Gov't 1 NGO 2 Bought 3 Friend 4 Other 5	**304. Cost per net from sources above** Gov't ……. NGO…….. Bought…… Friend……. Others…….	**305.** How many sleep-ing beds / mats do you have? ……	**306.** Whose beds are fitted with bed-nets? 1. Household head 2. Spouse 3. Bed shared with spouse 4. Children 5. Visitors 6. Others	**307.** Did you personally use a net last night? 1. Yes 2. No	**308.** How many times do you wash your bed-nets? 0=Never 1=Once/year 2=Twice/year 3=3-6 times/year 4=Monthly 5=Other, specify:

Household current bed-net use distribution

Household member (old to young)	***HCB1*** Does …… use bed-net	***HCB2*** Since when did s/he start	**HCB3** How many times had s/he suffered malaria?	***HCB4*** For non bed-net	***HCB5*** Has	***HCB6*** How do you see the

	1=Yes 2=No→HCB4	using bed-net? M =Month Y=Year	**HCB3A** 12 months before starting to use a bed-net →HCB5	***HCB3B*** 12 months after using net (if less than 12 months in use, specify the time period) →HCB5	users, how many times does s/he suffers malaria attack in a year on average?	there been any change in frequency of malaria attack since he started using bed-net? 1=Yes 2=No (Stop) 3=DK (stop)	frequency of her/his malarial attacks since started using the net? 1=reduces 2=increases 3=No change
1	1 2	M Y				1 2 3	1 2 3
2	1 2	M Y				1 2 3	1 2 3
3	1 2	M Y				1 2 3	1 2 3
4	1 2	M Y				1 2 3	1 2 3
5	1 2	M Y				1 2 3	1 2 3
6	1 2	M Y				1 2 3	1 2 3
7	1 2	M Y				1 2 3	1 2 3

8	1 2	M	Y				1 2 3	1 2 3
9	1 2	M	Y				1 2 3	1 2 3
10	1 2	M	Y				1 2 3	1 2 3
11	1 2	M	Y				1 2 3	1 2 3
12	1 2	M	Y				1 2 3	1 2 3
13	1 2	M	Y				1 2 3	1 2 3

Section B. Ask Q.309 – 312 only to respondents who currently not using bed-nets in their households

309.	**310.**	**311.**	**312.**
Have you ever personally used a bed-net? 1. Yes 2.No	Why have you never used a bed-net? 1. I'm not bothered by mosquitoes 2. Feel uncomfortable under a net 3. Too expensive 4. Nets are hot 5. I don't know where to buy from 6. Not aware of Bed-net → **Q. 408** 7. Does not protect against malaria 8. Malaria is a recent disease here 9. Others	From your own opinion, how much do you think a net should cost (Birr)? ……Birr 99. DK	What then do you think are the problems associated with sleeping under a bed-net? 1. Too hot to sleep under 2. Mosquitoes still bite through 3. Disorganises you from getting up at night 4. Deprives you from air 5. I fear getting poisoned 6. Other (specify)

Section 4: Insecticide Treated Bed-nets (ITN)

401	**402.**	**403.**	**404.**	**405.**	**406.**	**407.**
Have you ever heard of ITN? 1. Yes 2. No →**Q.408**	From where was the information? 1. Friend/family 2. Health professional 3. Posters 4. Radio 5. Newspaper 6. Can't remember 7. Other (specify)	What do you think are the reasons for treating bed-nets? 1. To kill mosquitoes 2. To make the net stronger 3. To repel mosquitoes 4. Prevent malaria 5. Others (specify) 99.DK	Where can we get ITN from this area? 1. Shop 2. Pharmacy 3. Health centre/clinic 4. Market 5. Other (specify) 99. DK	How many times have you treated your bed-net(s) with insecticide? Number:_____ If 0: →**Q.408**	How much did it cost for each treatment? Birr	After how long should the bed-nets be retreated? Times/Year 99. DK

408: EXPLAIN THESE STATEMENTS FIRST TO A RESPONDENT INORDER TO ANSWER QUESTIONS BELOW (Q.408-Q.410); SHOW THE PICTURE OF A BED-NET ALSO TO THE RESPONDENT (SEE NEXT PAGE).

I am now going to explain to you what an Insecticide Treated Bed-net (ITN) is. This explanation will help you to answer the following questions that I am going to ask you. A treated bed-net is almost like any other ordinary bed-net. The only difference is that it is treated with insecticides. These insecticides

are safe to human being, but effectively kill and repel the mosquitoes. This will protect the person sleeping under the bed-net against malaria and other insects like bedbugs and cockroaches. The treatment is done by dipping a clean net into a recommended dosage of chemical insecticide solution until it is completely wet. The wet net is then dried on a clean surface. Retreatment can be done twice or more times a year depending on how frequently the net is washed.

Think about the costs of malaria burden to your household (in terms of costs of treatment, lost time, pains (sufferings) and any other costs due to sickness); number of bed-nets available to your household; and your household expenditure to be met in the near future,

408A. Are you willing to offer any cash to have this additional bed-net if somebody is to supply?

1. Yes→**Q.409** 2. No 99. DK

408B. What if I ask you to sacrifice some of your labour time to work for this bed-net?

1. Yes→**Q.410** 2. No 99. DK

409. We would like to determine the maximum amount that you are willing to pay per additional bed-net for your household?

409A. If yes in Q.409A, Are you willing to pay 15 Birr for a bed-net?

1 = Yes 0 = No→**Q.410C**

409B. What if the price is 30 Birr would you be willing to pay? **(ALL GO TO Q.409D)**

1 = Yes 0 = No

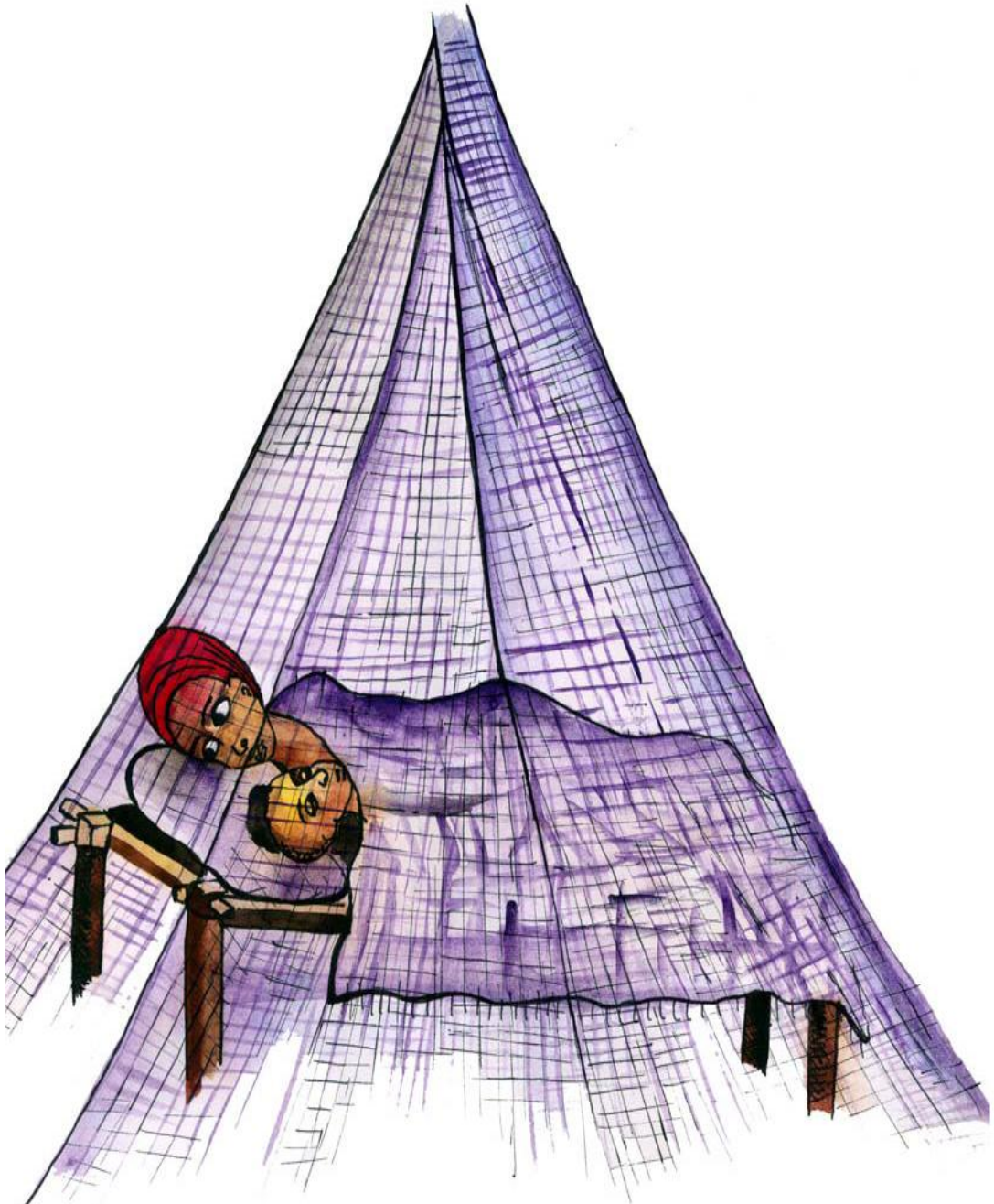
409C. What if the price is 7.5 Birr, would you be willing to pay?

1=Yes 0=No

409D. what then, is the maximum amount you are willing to pay for a bed-net? ----------Bir

410. If yes in Q408B, what maximum amount of time are you willing to work for a bed-net?----------Mandays

THANK THE RESPONDENT



Plot Level Questionnaire 2010 Tigray Survey

Household Name:	Interviewer:	**GPS Coordinates for home of household:**	**Altitude (masl)**
Household Id. No.:	Date of Interview:	1.	
Kushet:	Tabia:	2.	

Does the household have a land certificate? 1=Yes 0= No If yes, **Year (EC) of receiving the certificate:_____**

Land certificate information (copy information from land certificate), If no, **why no certificate**? 1=did not collect it, 2=No land at that time, 3=Too small land, 4=Land was not registered, 5=Tabia did not give me, 6=Lost it, 7=Other, specify

Registration number on certificate: _____

Full name (owner):_____Sex of owner: _____

Is owner current head of household? Yes No If no, relationship between listed owner and hhhead: HHhead is……

Family size when land was allocated:_____ The time when the last land allocation was made: _____ The number of plots allocated: _____

Plot No.	The name of the place where the plot is located	Distance (minutes)	Soil depth of the plot (Deep=1, medium=2, or shallow=3)	Plot size in Tsimdi	Measuredplot size in Tsimdi	The plot is Adjacent to…..	GPS Coordinates	Altitude (Elevation)	Origin of plots	Who decide on plots	Who work on plots
						E: _____ N: _____ W: _____ S: _____					

1											
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					

Origin of plots: 1. Husband/Husband's family, 2. Wife's family, 3. Government. 4. Tabia, 5. Other, specify….

Who decide on plots (make production and investment decisions): **1**.Husband/male head, **2.**Wife, **3.**Joint husband/wife, **4.**Female head, **5**.Son, **6.**Other, specify:

Who work on plots: **1.**Husband/male head, **2.** Whole family, **3.**Joint husband/wife, **4.**Female head, **5.**Wife, **6.**Son, **7.**Other, specify:

Cross/check information with plot level data from our earlier survey rounds:

Continued....

Household Name:	Household Id. No.:	Interviewer:

Plot No.	The name of the place where the plot is located	Distance (minutes)	Soil depth of the plot (Deep=1, medium=2, or shallow=3)	Plot size in Tsimdi	Measured plot size in Tsimdi	The plot is Adjacent to…..	GPS Coordinates	Altitude (Elevation)	Origin of plots	Who decide on plots	Who work on plots
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					
						E: _____ N: _____ W: _____ S: _____					

						E: _____ N: _____ W: _____ S: _____					

Origin of plots: 1. Husband/Husband's family, 2. Wife's family, 3. Government. 4. Tabia, 5. Other, specify….

Who decide on plots (make production and investment decisions): **1**.Husband/male head, **2.**Wife, **3.**Joint husband/wife, **4.**Female head, **5**.Son, **6.**Other, specify:

Who work on plots: **1.**Husband/male head, **2.** Whole family, **3.**Joint husband/wife, **4.**Female head, **5.**Wife, **6.**Son, **7.**Other, specify:

Cross/check information with plot level data from our earlier survey rounds:

NB! Fill plot number continuing from plot numbers on previous page and use carefully the same plot numbers and order of plots in the following pages.

Household Name:	Household Id. No.:	Interviewer:

Does the household have plots that are not listed on the certificate? Yes = 1 No = 0

If yes, list the plots

Plot No.	The name of the place where the plot is located	Distance (minutes)	Soil depth of the plot (Deep=1, medium=2, or shallow=3)	Plot size in Tsimdi	Measuredplot size in Tsimdi	GPS Coordi-nates	Altitude (Elevation)	Origin of plots	Who decide on plots	Who work on plots

Origin of plots: 1. Husband/Husband's family, 2. Wife's family, 3. Government., 4. Tabia, 5. Other, specify….

Who decide on plots (make production and investment decisions): **1**.Husband/male head, **2.**Wife, **3.**Joint husband/wife, **4.**Female head, **5**.Son, **6.**Other, specify:

Who work on plots: **1.**Husband/male head, **2.** Whole family, **3.**Joint husband/wife, **4.**Female head, **5.**Wife, **6.**Son, **7.**Other, specify:

Cross/check information with plot level data from our earlier survey rounds:

NB! Fill plot number continuing from plot numbers on previous page and use carefully the same plot numbers and order of plots in the following pages.

Household Name:	Household Id. No.:	Interviewer:

Land rental and partners in rental market

Have you rented in or out land during the last year? Yes=1 No=0 If no, skip this page.

NB! Keep plot number the same as in land certificate and the following list of plots

			Rented-in plot		Rented-out plot			If the plot is transacted, details about rental partners				
Plot No.	Plot Name	Tenure status	2000 1=yes 0=no	2001 1=yes 0=no	2000 1=yes 0=no	2001 1=yes 0=no	Reasons for renting out	Name	Relationship	Kushet	How long has the contract partnership lasted?	Where rental partner lives

Tenure status: 1.Own land with certificate, 2.Own land without certificate, 3.Rented in, 4.Transferred, 5.Inherited, 6.Other,specify:

Reasons for renting out: 1= lack of labour, 2= lack of oxen, 3= unable to rent oxen, 4=lack of cash, 5= credit obligation, 6=other, specify…,

Relationship: 1=husband's close relative, 2=wife's close relative, 3=distant relative, 4=ex-husband/ex-wife, , 5= non-relative, 6=Son/Daughter, 7=other, specify,

Where rental partner lives: 1= within the kushet, 2= within the tabia, 3= A closer tabia, 3= distant tabia, 4= other, specify.

How long: How many years has the contract partnership lasted

Household Name:	Household Id. No.:	Interviewer:

Land characteristics

! Keep plot number the same as in land certificate and the following list of plots

Plot No.	Plot Name	Irrigated? 1=yes, 0=no	Soil Type	Soil Depth	Slope	Land quali-ty	Weed in-festation	Susceptibility to erosion	Degree of soil erosion /degradation
1									

Codes: a) **Soil type**: 1. Baekel, 2. Walka, 3. Hutsa, 4. Mekeyih, **Soil depth**: 1.Shallow, 2. Medium, 3. Deep,

Slope: 1. Meda, 2. Tedafat (foothill), 3. Daget (midhill), 4. Gedel (steep hill)

Land quality: 1. Poor, 2. Medium, 3. Good, **Weed infestation:** 1. High, 2. Medium, 3. Low

Susceptability to erosion: 1. High, 2. Medium, 3. Low, 4. None

Degree of degradation: 1. Highly degraded, 2. Degraded, 3. Moderately degraded, 4. No degradation

Number of Visits to Plot (May 2001 – May 2002)

Plot No.	Plot Name	Land preparation		Planting		Manuring/ Fertilization		Weeding		Inspecting/ (scaring birds)		Harvesting		Threshing		If landlord, monitoring visit		Total No. of visits	No. of Sole visits
		No.	Who	No.	Who	No.	Who	No.	Who	No.	Who	No.	Who	No.	Who	No.	Who		

No: Number of Visits

Who: Persons visited the plot: 1= Husband, 2= Wife/female head, 3= Husband and wife, 4= Husband and Son,

5= Others, specify __

Land market participation

Fill in if household has participated in the land rental market (including sharecropping in or out) during the last year.

! Keep plot number the same as in land certificate and the following list of plots

Household No.:										Interviewer:								
HH name										Data of Interview:								
Kushet:										Woreda:								
Tabia:										Zone:						**Who decides**		
2006 plot		Land rental markets								Byproducts, who get them?			Responsibilities			Contract	Crop	Share
no	Plot Name	Contract	Type	Duration	If dura-tion>3 yrs, specify	Pay ment	Advance payment	Paid when	Cost-sharing arrange-ment	Crop resi-dues	Manure	Grasing	New SWC	Maintain SWC	Pay land tax	type	choice	rate/Rent

Contract: 1. Fixed rent (cash), 2. Fixed rent (Kind), 3. Sharecropping (output only), 4. Cost sharing, 5. Output sharing after deduction of (cash) input costs,

6.Other, specify: **Type: 1.** Oral without witness, 2. Oral with witness, 3. Written and unreported. 4. Written and reported to tabia.

Duration: 1. 1 year, 2- 2 years, 3. 3 years, 4. >3 years, specify……., 5. Open ended.

Payment: Fixed rent: cash amount, Sharecropping: Share of output to the landlord (Code: 1. 50%, 2. 33%, 3. 25%, other, specify:……

Advance payment: Cash amount in sharecropping contracts.

Paid when: 1. Before cultivation, 2. After harvest, 3. Other, specify:……..

Costsharing arrangement: 1. Landlord pays fertilizer and seed, 2. Landlord and tenant share cash input costs, 3. Other, specify:……

Byproducts, who gets them/Responsibilities/Who decides: 1.Landlord, 2.Tenant, 3.Shared, 4. Open

Crop choice: 1. Landlord, 2. Tenant, 3. Follow follwing crop rotation system (specify): ……..

Household Name:	Household Id. No.:	Interviewer:

Tree planting and harvesting

2006 Plot	Stock of main trees on plot by age and number	How many trees have you planted on the plot in the last….	Number of trees harvested in the last	How has the number of

no.	Eucalyptus			Other trees			Eucalyptus		Other trees		Eucalyptus		Other trees		tress changed in the last 5 years
	0-3 years	3-8 years	>8 years	0-10 years	10-20 years	>20 years	Last year	2-5 years ago	Last year	2-5 years ago	Last year	2-5 years ago	Last year	2-5 years ago	1 =increased 2=constant 3=decreased

Household Name:	Household Id. No.:	Interviewer:

Plot no.	Sub-plot	Sea -son	Plot Name	Crop grown	Area planted	crop output Kg	Seeds		Manure in Kg	Urea in Kg	Dap in Kg	*Herb and pesticide* *Birr*	Number of labor man days					oxen
							Type	Kg					Plow-ing	Weed-ing	Harvest-ing	Thresh-ing	hired labor	
1																		

Season: 1=Meher (rainy season, 2=Dry season 1 (irrigated land), 3=Dry season 2 (irrigated land)

Crops grown: C1. Barley, C2. Wheat, C3. Teff, C4. Maize, C5. Millet, C6. Sorghum, C7. Field pea, C8. Bean, C9. Linseed, C10. Lentil, C11. Hanfets

Vegetables: V1. Onion, V2. Potato, V3. Tomato, V4. Letus, V5. Cabbage, V6. Carrot, V7. Pepper, V8. Others

Perennials:P1. Orange, P2. Banana, P3. Eucalyptus. P4. Guava, P5. Papaya, P6. Coffee, P7. Others, Specify……..

Seed type: 1. Improved, 2. Local, 3. Others, specify

Oxen: 1. Own oxen, 2. Shared oxen, 3. Oxen exchange with labour, 4. Borrowed oxen, 5. Rented oxen for cash, 6. Other, specify:

Household Extension Package and impact for the household

1. Ask these questions to wife or female head of household

S.no	Questions	Unit	Answer
1	Has your household been in contact with the health extension agent in the tabia? 1=Yes, 0=No	Code	
2	If yes, how many times the last year?	Number	
3	If yes, how many visits have you made to the health post during last year?	Number	
4	If yes, how many visits did you get at your house from the health extension agent?	Number	
5	Which of the following health package programs have you received information about from the health extension agent during the last 3 years? 1=Yes, 0=No		
7	1= Sanitation package, toilet building	Code	
8	2=First aid	Code	
9	3=Environmental hygiene	Code	
10	4=Personal hygiene	Code	
11	5=Family planning	Code	
12	6=Nutrition and micronutrient requirements	Code	
13	7=HIV/Aids diagnosing and treatment	Code	
14	8=Malaria prevention and treatment	Code	
15	9=Drinking water preparation	Code	
16	10=Other, specify:	Code	
17	Which of the health packages that you have had information on has affected the behavior of the household and has been im-	Codes	

	plemented? Use codes from above		
18	Which of the packages do you consider most important for your household?	Codes	
19	Which of the packages has had strongest positive impact on the health of household members? 99=None of them has had any impact on the health	Code	
20	Explain the impact:		
21	What is your opinion on the importance of family planning in your community? 1=Unimportant, 2=Important for the most poor households, 3=Important for all households.		
22	What do you consider as an acceptable number of children in a family? 1=Free to choose, nobody else's business, 2=5-10, 3=4-5, 4=2-3, 5=1, 6=Depends on household resources, 7=Other:		
23	Do your household members use soap when washing their hands after having been to the toilet and before eating? 1=Yes, 0=No, 2=Often, 3=Rarely		
24	Do you and your family use boiled drinking water? 1=Yes, always, 0=No, 2=Most of the time, 3=Occasionally.		
25	If no or rarely, why not? 1=		
26	How is the health situation of the household now compared to 1 year ago?	Better	
		The same	
		Worse	

27	If better or worse, why has it changed?		

28	What could be done to reduce the health problems in the household?		