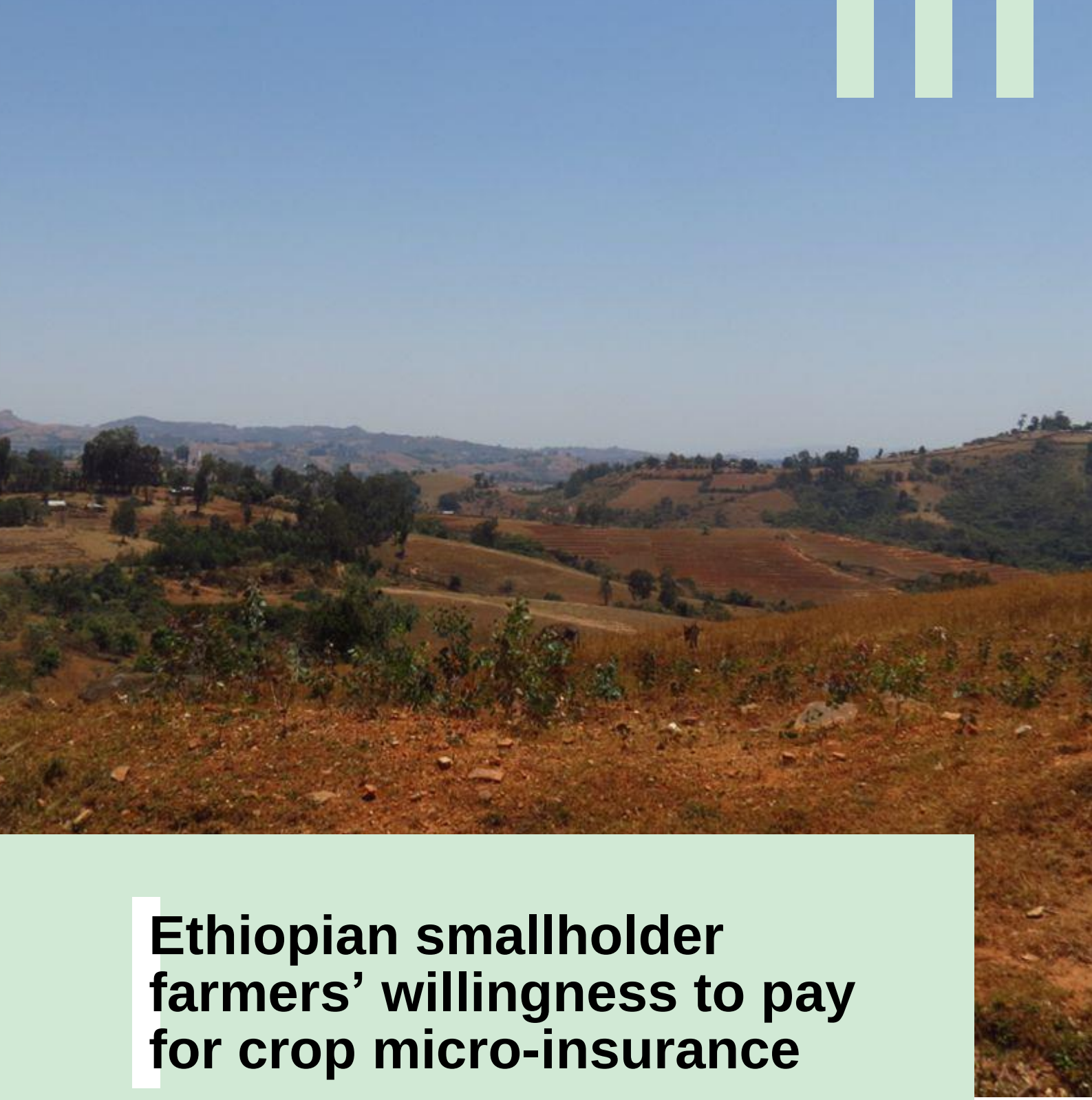

Ethiopian smallholder farmers' willingness to pay for crop micro-insurance

Prepared for the Global Green Growth Institute

SEPTEMBER 2019

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DATA | RESEARCH | ADVISORY

Ethiopian Smallholder **Farmers' Willingness to Pay** (WTP) for Crop Micro-Insurance

Final Report | September, 2019

Prepared for the Global Green Growth Institute

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Acknowledgements and authorship

This report was authored by Cox Bogaards, Carlo Menon and Dimitri Stoelinga of Laterite. The field work was led by Fitsum Dagmawi and Melese Alemu Wondemu, both of Laterite. The authors would like to thank the Global Green Growth Institute (GGGI) for commissioning this study.

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Abbreviations

ACC	Agricultural Commercialization Clusters
ATA	Agricultural Transformation Agency
CPS	Crop Production System
CBHI	Community Based Health Insurance
CVM	Contingent Valuation Method
ECIAF	Ethiopian Climate Insurance Guarantee Fund
ESSI	Ethiopian Space Science Institute
ETB	Ethiopian Birr
LIFT	Land Investment for Transformation
GGGI	Global Green Growth Institute
GTP II	Growth and Transformation Plan II
NDVI	Normalized Difference Vegitation Index
PPI	Poverty Probability Index
VICI	Vegetation Index Crop Insurance
WTP	Willingness to pay

1. Introduction

The Global Green Growth Institute (GGGI) has partnered with Kifiya and Ethiopia's Agricultural Transformation Agency (ATA) to explore the option of creating a fund to support the introduction and scale-up of crop micro-insurance[1] products that meet the needs of Ethiopian farmers.

The fund, to be known as the "Ethiopian Climate Insurance Guarantee Fund" (ECIAF), will have two objectives:

i) To help farmers pay for crop micro-insurance by providing a partial premium subsidy; and
ii) To act as a back-up mechanism to prevent insolvency of insurance firms.

The fund will be time-bound and is intended to facilitate the emergence of a commercially viable market for crop micro-insurance products.

During the five years in which the ECIAF is intended to operate, the partial premium subsidy will support smallholder farmers, allowing them to purchase policies and enter the micro-insurance market, without encouraging dependency. ECIAF's guarantee mechanism will cover losses of the insurance companies. It is expected that the product will be commercially viable after five years, with sufficient farmers enrolled to lower the operating and management costs, allowing them to purchase the product at a commercial rate with no subsidy. During the same period, the insurance companies will collect the necessary risk data that will make re-insurance possible after five years.

The three partners will bring complementary capabilities to this initiative. Kifiya, as a financial technology (Fintech) company, will be responsible for the design of the insurance products. ATA, which is implementing Ethiopia's Agricultural Transformation Agenda, will leverage its networks to aid with farmer communication and facilitate the roll-out of the crop micro-insurance products. GGGI will provide technical expertise during the start-up phase and is reponsible for finding donors to realize this guarantee facility.

Laterite was engaged to assess farmers' willingness to pay (WTP) for a crop micro-insurance product, and to identify farmer preferences for one of two potential insurance products, which we refer to as "drought" or "hybrid" insurance. This study is based on a quantitative survey targeted directly at farmers in four regions of Ethiopia (Amhara, Oromia, SNNPR and Tigray). The insights generated in this study will help GGGI, ATA and Kifiya better understand the needs of farmers and their perceptions, preferences and WTP with respect to crop micro-insurance. Furthermore, the research gives an overview of household characteristics along with saving and risk management mechanisms. Finally, the study is designed to provide useful inputs for the design of the micro-insurance products, including on the timing of payments and perceptions of different loan providers.

[1] See section 1.1 for an explanation of crop micro-insurance

1.1. Background: crop micro-insurance in Ethiopia

Ethiopia has roughly 13 million (2007/08 estimate) smallholder farmer households that account for 95% of agricultural production, and 85% of all employment in Ethiopia (FAO 2011; Taffesse et al. 2012).

In rural areas in Ethiopia, crop loss is a significant concern among farmers and occurs regularly. Many farmers experience crop loss due to weather events, pests and diseases. Farmers are vulnerable to weather events, especially drought, because most of the agriculture in Ethiopia is rainfed. In 2017, the income of farmers that reported crop loss decreased from USD 323 in a normal year to USD 123 in a bad year – an average decrease in income of almost 40% (Biese et al. 2018). More than 90% of the farmers that experienced crop loss in 2017 reported moderate to great financial hardship as a consequence (Biese et al. 2018).

Ethiopia's Growth and Transformation Plan II (GTP II) aims to prevent food security disaster and reduce poverty (National Planning Commission 2016). Lower crop yields have large impacts on the livelihood of Ethiopian farmers through their effects on food supply and farmers' income. Lower crop yields may mean that farmers have insufficient food to feed their households. Crops are also used to feed livestock which are used to plough fields. In addition, farmers' investments into agricultural inputs, which are often purchased with a loan, are lost. To prevent food security disasters, the GTP II aims to, among others, stimulate the development and expansion of climate-related risk insurance.

Crop micro-insurance decreases smallholder **farmers' vulnerability to external shocks** by enabling them to cope with events that negatively affect their yield, without having to pay the high premiums associated with traditional indemnity-based insurance. Farmers use many informal coping methods to cover their crop losses including savings, gifts from family, selling of assets and government assistance. However, approximately half of the respondents reported not being able to cover the full value of their crop losses (Biese et al. 2018). Crop micro-insurance can prevent the loss of income in bad years by providing payouts to farmers who experience crop loss. In the long term, this will allow them to invest in more agricultural technologies and saving mechanisms making them less vulnerable.

Both donor-driven and commercial products have been piloted in the Ethiopian context, but none have been upscaled. Some pilot programs have not been upscaled because they were donor driven and when the donor withdrew, the program discontinued. Purely commercial micro-insurance schemes have also been piloted, but have had variable success. In 2016/17, approximately 7,000 farmers bought commercial micro-insurance from Kifiya, but this number dropped drastically in 2018 when good rainfall resulted in minimal payouts. The farmers were unable to pay for the premium rates without a subsidy. There is a lot to be learned from previous experiences in the Ethiopian context, though research on the topic in the Ethiopian context is limited.

Evidence shows that farmers in the Ethiopian context express interest in micro-insurance, but actual uptake is low. Primary data on micro-insurance is scarce, but we do know that there is a high interest for micro-insurance products among farmers (Amha et al. 2012). Kifiya find that although insurance literacy is low, almost 60% of the surveyed farmers are interested in purchasing some form of micro-insurance. Farmers want more information about micro-

insurance products and perceive it as a useful instrument to decrease risk. Negative bias towards insurance products is low (Biese et al. 2018). However, actual uptake also remains low.

Part of the reason uptake is low is willingness-to-pay (WTP) for crop micro-insurance in the Ethiopian context. A study on the WTP for a weather-index-based crop insurance was piloted in the Shasemene District. The key insight was that without subsidy the uptake rate was minimal. Farmers that were interested in the insurance product were willing to pay a premium rate of 12.9% on average. Those who did not want to pay were expecting the government or donors to pay for such services (Woldegiorgis 2014). Another study administered across four regions in Ethiopia, led by the World Bank, showed a WTP of less than 5% of the total coverage for crop insurance (Biese et al. 2018). This indicates that trying to understand WTP patterns before launching new micro-crop insruance products is important.

1.2. Drought and hybrid insurance

Drought insurance

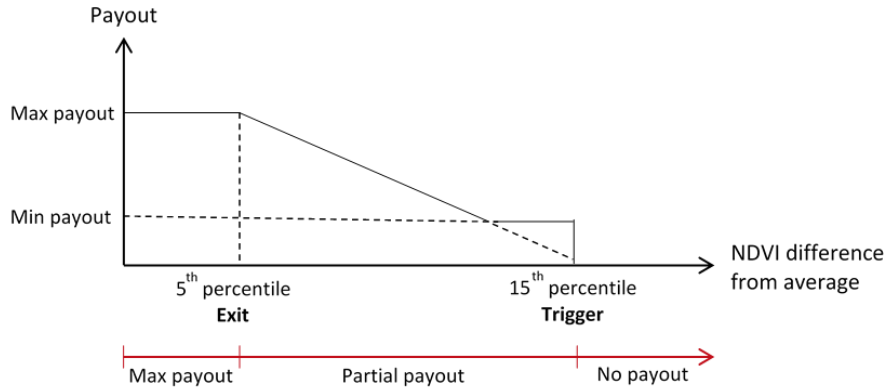
Kifiya has developed a Vegetation Index Crop Insurance (VICI) product, that protects farmers against drought **("drought insurance")**. The product was developed in collaboration with the University of Twente and is currently being transferred to the Ethiopian Space Science Institute (ESSI).

This product makes use of a Normalized Difference Vegetation Index (NDVI), a graphical indicator that uses remote sensing and satellite data to analyze whether the vegetation is green and alive. Ethiopia has been divided into 1km^2 grids, each assigned with one of 200 Crop Production System (CPS) zones. The NDVI is calculated every 10 days. The final payout is based on the difference between the current NDVI of each CPS zone and the distribution of the NDVI value of that same zone, collected over the past 40 years. The minimum payout to the farmer is triggered when the actual measured NDVI value lies below 15% of the CPS zone observations over time (15th percentile). When the measured NDVI lies below 5% or less of the total number of observations for that CPS, the farmer will receive a maximum payout. For NDVI values that lie between 5 and 15% of the total number of observations, the farmer will receive a partial payout.

Figure 1 on the next page shows the relationship between the payout and the difference of the NDVI from the median value.

The VICI product has been sold on a commercial basis by two insurance companies over the past three years, with a total of approximately 7,000 policies sold. However, this product has been losing popularity due to the high premium rates (there is no subsidy component) and good rainfall during 2018.

Figure 1. Relationship between NDVI difference from median and payout



Hybrid insurance

Kifiya is currently developing a hybrid product that protects the farmers from pests and diseases in addition to drought **("hybrid insurance")**. This product incorporates both the VICI (drought insurance) model and an area-index yield model. For the area-index model, if the farmers report pests and diseases, approximately five 1m^2 plots planted with cereal are randomly selected from the assigned 1km^2. These plots are harvested, weighed and measured against the average yield for that location. The payout is then calculated by combining the VICI and an area-index yield model. Should no pests and disease be reported, only the VICI model will be used.

The financial sustainability of the hybrid product has not been tested, and therefore it has not yet been accepted by the insurance companies and sold on a commercial basis to date. However, recent annecdotal evidence from the LIFT (Land Investment for Transformation) program indicates that farmers have a stronger preference for an insurance product that would incorporate both drought, and pests and diseases.[2] Also, in view of the decreasing numbers of farmers presently holding index-based insurance like VICI, one of the aims of this survey is to determine farmers' interest and WTP for this hybrid model.

For the purpose of this study we will use 15% of coverage as the commercially viable premium for drought insurance and 25% of the coverage as the commercially viable premium for hybrid insurance. According to Kifiya, the drought insurance product becomes financially viable when the premium is priced at 15% of the insurance coverage. The commercially viable premium for hybrid insurance is uncertain because the financial sustainability of the product has not yet been confirmed. It is estimated that the commercially viable rate will range between 20% and 25% of the coverage. Taking a conservative approach, we use 25% as the commercially viable rate for hybrid insurance in this report.

[2] The Land Investment for Transformation programme aims to improve land tenure security for farmers through introducing a second-level land certification, increasing access to credit, establishing a rural land administration, etc. (https://www.dai.com/our-work/projects/ethiopia-land-investment-transformation-lift).

1.3. Research questions

This **report studies farmers'** willingness to pay (WTP) for two different crop micro-insurance products in the Ethiopian context, prior to the roll-out of these products. This study also aims to better understand the target consumers of these insurance products and their preferences. Throughout the report, relevant insights that might influence the design of these micro-insurance products are highlighted.

This study will answer the following research questions:

- How much compensation do farmers require to be able to recover from an external shock arising due to drought or pests and diseases?
- What risk management strategies do farmers currently use, and how will availablity of insurance prevent them using unfavorable risk management strategies?
- Are farmers willing to pay for crop micro-insurance? If not, why?
- Which micro-insurance product best meets the needs of farmers in Ethiopia: the drought or the hybrid insurance?
- When do farmers prefer to pay their premiums? And from which insurance provider do farmers prefer take out a loan?

2. Research Methodology

2.1. Target population

GGGI, ATA and Kifiya aim to first roll-out the insurance product to smallholder farmers, who own or use land planted with cereal crops, in Agricultural Commercialization Clusters (ACCs) in four Ethiopian regions (Amhara, Oromia, SNNPR and Tigray). ACCs are Woredas[3] that are prioritized for interventions based on a select number of food and other crops the government has chosen to target: for cereals, these include teff, wheat, maize and barley. Various interventions to increase production and productivity have been deployed in these Woredas.

ACCs are called **'Centers of Excellence' serving as an example for other** Woredas in the region (Agricultural Transofmration Agency 2019). ATA has extensive contact with farmers living in these Woredas. The hope is that ATA extension officers (one in each Kebele[4]) might be able to support the introduction of crop micro-insurance and facilitate the roll-out of these products at the local level. We therefore select farmers living in ACCs for the purpose of this survey. Generally, if a Kebele is within an ACC most of the farmers are ACC farmers. The prior is that ACC farmers are likely to have a higher ability to pay for products such as crop insurance.

The insurance products will only be available to smallholder farmers. Smallholder farmers are defined as farmers that own or use land planted with not more than five hectares of cereal crops. Cereal crops include maize, barley, sorghum, teff and wheat.

Because of the selection criteria above, the results are not representative of an average Ethiopian farmer, but rather of a smallholder ACC farmer living in Woredas that grow specific crops.

Sampling strategy

The selected sampling strategy achieves a compromise between the research objectives for this exercise, the available budget and the available information on the underlying population of interest.

One of the intended research objectives was to estimate the WTP for the two micro-crop insurance products by region and crop type. There were four regions of interest for this study (ACC areas in Amhara, Oromia, SNNPR and Tigray) and five target crops (Maize, Barley, Sorghum, Wheat and Teff). These combine to 20 region-crop combinations. Achieving sufficient statistical power to estimate WTP with a relatively high degree of precision in each of the 20 blocks, would have required a much larger sample size than the budget for this exercise could afford.

Another issue that limited the sampling options available, was the lack of information on which crops were produced in which locations. In order to make this survey feasible, it was important

[3] Woredas are administrative units in Ethiopia. Regions in Ethiopia are sub-divided into Woredas; on average there are about 85 Woredas per region.

[4] Kebeles are administrative units in Ethiopia. Regions are divided into Woredas, which are divided into Kebeles. Kebele consist of slightly more than 1,000 households on average.

to target locations with a high proportion of farmers growing one of the target crops. However, this information was only available at the Woreda level, not at the level of smaller administrative/geographic units (Kebeles and below). There was also no list available of all the Kebeles within the target Woredas. The lack of budget to conduct a listing exercise at lower levels of geographic aggregation, meant that it was only possible to stratify the sample at the Woreda level, in order to achieve the desired mix of regions and crops.

The resulting sampling strategy – described below – allows us to collect information from all four regions and from farmers growing each of the five different crops; it does not however allow us to generalize results to the region/crop levels. We use regression analysis where possible to detect statistically meaningful differences in the WTP between regions or between different crops and discuss what some of these differences might imply. It is important to remember that data was collected from 13 different Woredas, across four different regions, which means that the results presented in this study will be influenced by the idiosyncratic characteristics of the selected Woredas (the fewer the number of Woredas, the greater the influence of each individual Woreda on the estimates obtained). The proposed sampling strategy and the resulting sample, while subject to selection bias and low statistical power, does allow us to derive some very interesting insights on the target farming populations and their WTP for micro crop insurance products.

The sampling strategy was structured as follows:

- Sampling frame. The sampling frame used for this exercise was the ACC Woreda list, which included details on the region and main crop of each Woreda.
- Stratification: The sample was stratified by region and the primary crop of each Woreda. The number of ACC Woredas per region varied, as did the number of Woredas within a region by primary crop. Not all regions had all combinations of crops (for example there were very few Woredas where Sorghum was the primary crop). Moreover, budget constraints limited the sample to 13 Woredas, even though there were slightly more possible combinations of Woredas and crops (the least important combinations of region-crop were dropped). Table 1. shows the resulting number of Woredas selected by region and crop-type. This sample allows us to strike as good a balance as possible between regions and primary crop, given the budget and information constraints.
- Multiple levels of clustering. Within each Woreda, the field team listed all the Kebeles. We then proceeded to randomly selected two Kebeles per Woreda (making replacements where necessary due to the security situation in a few Kebeles or if the selected Kebele was urban). In total, the sample consisted of 26 different Kebeles. Listing at the Kebele level was not an option with the available budget, since there are on average more than 1,000 households living within each Kebele (this would have required listing 26,000 different households). It was therefore necessary to further cluster, at the cost of statistical precision. Within each Kebele, we further selected one or two Zones. Zones are not official administrative units, but exist in all Kebeles. After sampling a zone, we randomly sampled households within zones. The sampling frame for the Kebeles, zones and households was obtained through a listing exercise. A more elaborate overview of the sampled Kebeles by Woreda and primary crop type can be found in Annex B.

Table 1. Distribution of sample across region and type of crop (number of Woredas)

Region	Maize	Barley	Sorghum	Teff	Wheat	Wheat and Barley
Amhara	1	1	-	-	1	-
Oromia	2	1	-	1	-	1
SNNPR	1	-	-	1	1	-
Tigray	-	-	-	1	1	-

2.2. Selecting farmers to survey

To be eligible to buy the insurance product farmers need to:

i) be a smallholder farmer, and
ii) have planted at least one type of cereal crop on the land they own or use.

For the purpose of this survey, a smallholder farmer is defined as any farmer that owns or uses up to 5 hectares of land planted with cereal crops. Cereal crops of interest included maize, barley, sorghum, teff and wheat. Only eligible farmers were selected into the sample.

In order to estimate the WTP of farmers, it was also important to maximize the number of farmers that were willing to pay something for crop insurance in our sample. Our working assumption, based on previous research on crop insurance, was that the majority of farmers would not be willing to pay anything for crop insurance. Having a high proportion of farmers in our sample with a zero WTP for crop micro-insurance would have our ability and statistical power to say something about the farmers are willing to pay something for micro-crop insurance.

It was therefore important to pre-screen farmers. Using proxy indicators, we oversampled farmers that *apriori* were more likely to be able to purchase insurance products, and undersampled farmers that *apriori* were less likely to purchase insurance products. Our objective in doing so was to increase the precision of our estimates about the WTP of farmers for crop micro-insurance.

Pre-screening is not as simple as asking the farmer if they would like to buy crop micro-insurance or not. As insurance literacy is low, the question would have little meaning for the majority of respondents. Even if farmers were familiar with insurance, it would have been difficult for them to express whether they are interested in taking up an insurance product or not in such a situation where they have not considered the product before. Instead, we used formal education; income; and exposure to more than two years of crop loss over the past five years as proxies for WTP. Based on insights from other studies, our assumption was that farmers with higher income levels, more education or with a higher exposure to crop loss, would be more willing to pay. Pre-screening was done as follows: we interviewed all (100%) of the sampled farmers that had either formal education, a high income or more than two years of crop loss over the last five years. Only 50% of farmers that did not meet any of these three criteria were interviewed. Weights were used to correct for this imbalance.

2.3. Eliciting willingness to pay

Choosing a method

There are several possible approaches to estimating WTP in situations where the relevant product is not yet sold on the market.

There are three main contigent valuation methods (CVM) proposed in the literature:

i) An open-ended question;
ii) a bounded design, or
iii) a payment cards design.

The open-ended question approach directly asks respondents how much they are willing to pay for a product. Kuwawenaruwa et al. (2011) use an open-ended question to elicit WTP for health insurance in Tanzania by directly asking how much the respondent is willing to pay for health insurance. While this is a very simple way to elicit WTP, it may be difficult for the respondent to answer since they have not thought about the insurance and their corresponding WTP before they are asked the questions. Another version is the van Westendorp approach in which the respondent is asked how much they would consider too cheap, cheap or good value, expensive and too expensive for a product.

In a bounded design, respondents are asked whether they are willing to pay a random price for a product. Vargas et al. (2011) used this method to elicit WTP of a weather-index insurance in Ethiopia. They ask respondents' WTP for absolute insurance premiums.The bounded design can be expanded to include additional bounds such as open-ended questions or other prompted prices, random or not. For instance, Woldegiorgis (2014) uses a double-bounded approach in which two random prices are shown consecutively. Joffre-Bonet & Kamara (2018) take a similar approach to determine willingess to pay for health insurance in the informal sector of Sierra Leone. Instead of asking a random price-point once, they repeat this question with a new random price-point. McCarthy (2003) uses a 1.5 bound design to determine WTP for insurance in Morocco. In addition to asking whether a respondent is willing to pay a given price, she asks how much the respondent is willing to pay if they reject a high rate or accept a low rate. Fonta et al. (2018) use a dichotomous choice model followed by an open-ended question to elicit WTP for crop micro-insurance in West Africa. Respondents are shown a random price point. If they accept the offer, they are asked an open-ended question to elicit their maximum WTP. If they reject the price-point, they are asked to explain their choice (Fonta et al. 2018).

The payment cards design is based on showing the respondent multiple price options and asking them to choose the price they are willing to pay for the product. A World Bank study determines WTP for crop micro-insurance in Ethiopia by asking respondents how much coverage they prefer for a crop micro-insurance product. Respondents are then shown four different percentages of coverage (<5% - 15%) and asked for their willingness to pay (Biese et al. 2018). This approach has many biases including starting and strategic bias (Wedgwood & Samson 2003).

Having considered the different options and piloted the van Westendorp open-ended question approach in the field, we decided to **combine the "bounded"** and **"direct open-**

ended" methods and follow a similar approach to that of McCarthy (2003) and Fonta et al. (2018). We decided not to opt for the vn Westendorp approach, because during the pilot it became clear that this approach was too complex for the respondents. Respondents were having difficulty distinguishing between the different questions and between what would be considered "too cheap" or "too expensive". Often, respondents declared the same WTP for all four questions.

In this study we follow a bounded-design approach, followed by an open ended question. We opt to first ask the farmer whether he/she would buy the insurance at a random rate, selected from five different options. We then follow up with an open-ended question on the maximum price that the respondent would be willing to pay. The second question ensures that if the absolute premium rates we show are too high, we still have data points to be able to estimate WTP. We believe that the combination of the two approaches offers the right balance between accuracy and consistency of the results, on the one hand, and the need for simplicity and brevity, on the other.

Delivering the survey

The sample is randomly divided in two different groups of equal population size: the first group is assigned an insurance coverage of Ethiopian Birr (ETB) 2,000, the second group of ETB 4,000. We decide to use this split for two reasons: i) the coverage amount may influence farmers' WTP; and ii) the final product in the market will potentially offer flexible coverage to be chosen by customers, so it is important to test multiple coverage points.

The fact that both the coverage and the rate values are randomly selected ensures that the values are completely independent from any other socio-demographic characteristics of the respondent. Specifically, the procedure was implemented as follows:

i) First, survey respondents were asked whether they were willing to buy drought insurance with a coverage of ETB 2,000 or ETB 4,000 – depending on which premium coverage they were randomly assigned to - at a rate of 5%, 7.5%, 10%, 12.5%, or 15% of the coverage amount; and what maximum price they would pay for it.

ii) Subsequently, they were asked whether they were willing to buy hybrid insurance with the same coverage as the drought insurance at a random rate of 15%, 20%, 25%, 30%, or 35% of the coverage amount; and what maximum price they would pay for it. The rates for hybrid coverage are higher than the rates for the drought insurance because it covers additional risk. We also ensure that the rate for the hybrid insurance that is shown to the farmer is, at least, higher than the rate that they were willing to pay for the drought insurance. The hybrid insurance covers more risks than the drought insurance, and therefore, we assume that farmers are, at least, willing to pay the premium that they provided for the open-ended drought question.

Importantly, rates are prompted in absolute values, rather than as a proportion of the coverage (premium rate); therefore farmers have an immediate understanding of the amount that they would need to disburse. The share of respondents who declare to be willing to buy the product for each rate level and coverage provides an estimate of the "demand curve" faced by the insurance seller.

2.4. Presenting the two insurance products to the farmers

The two products were presented to the farmers in plain language, complemented by pictures to provide some practical examples of bad and good years. If the respondent did not have Community Based Health Insurance (CBHI), the section where drought insurance and CBHI were compared is not included in the explanation. The drought insurance was introduced to farmers with the following description:

> *"ATA and Kifiya have developed a drought insurance. A drought insurance is similar to CBHI. With your CBHI, you pay a one-time fee every year, and if you or your family member fall sick, CBHI will cover your medical expenses. If you are not sick and do not go to the hospital, you will not get your fee back. It is like a gamble, as you do not know what will happen.*
>
> *You will pay a fee to an insurance company before the planting season. [Image 1 from Figure 2 is shown to respondent]*
>
> *If there is a drought, you will get a one-time payment from the insurance company. If there is no drought, you will get no payment and you will not get your fee back. It is like a gamble, as you do not know what will happen.*
>
> *For this survey, the maximum payment that you could get is ${coverage} ETB. In practice however, you can choose what amount you want the payment to be. If the payment is higher, the fee will also be higher.*
>
> *In a year when the drought is very bad, you will receive the maximum payment of [Premium coverage respondent is randomly appointed to is shown] ETB. In a year when there is a drought, but not as bad as what I just showed you, you will receive a partial payment. The partial payment is less than [Premium coverage respondent is randomly appointed to is shown] ETB but more than the fee that you paid. In good years when there is no drought, you will receive no payment and you will not get your fee back [Images 2, 3 and 4 from Figure 2 are shown to respondent]*

Figure 2. Pictures shown to respondents to illustrate the timing of the payment and the difference between a good, bad and very bad year for drought.

The hybrid insurance was described as follows:

> *"Kifiya and ATA are also working on a hybrid insurance. The hybrid insurance protects you from drought as well as pests and diseases. It will only protect your cereal crops and you will have to pay a fee before the planting season. You could still get a maximum payment of [Premium coverage respondent is randomly appointed to is shown] ETB, or you could get nothing. This depends on the average amount of cereal crops that have been lost in your development group[5] due to drought, pests and diseases [Images 1, 2 and 3 from Figure 3 are shown to respondent].*

Figure 3. Pictures shown to respondents to illustrate difference between a good, bad and very bad year for pests and disease.

[5] Kebeles are divided into development groups. Each development group has a representative.

3. The Context

This section outlines the context of the target locations using socio-economic and demographic data collected during the survey. Understanding the context is essential to develop an effective and well-functioning crop micro-insurance market. This section looks at three socio-economic dimensions: poverty and vulnerability; agricultural activities; and insurance take-up and coping and mitigation strategies.

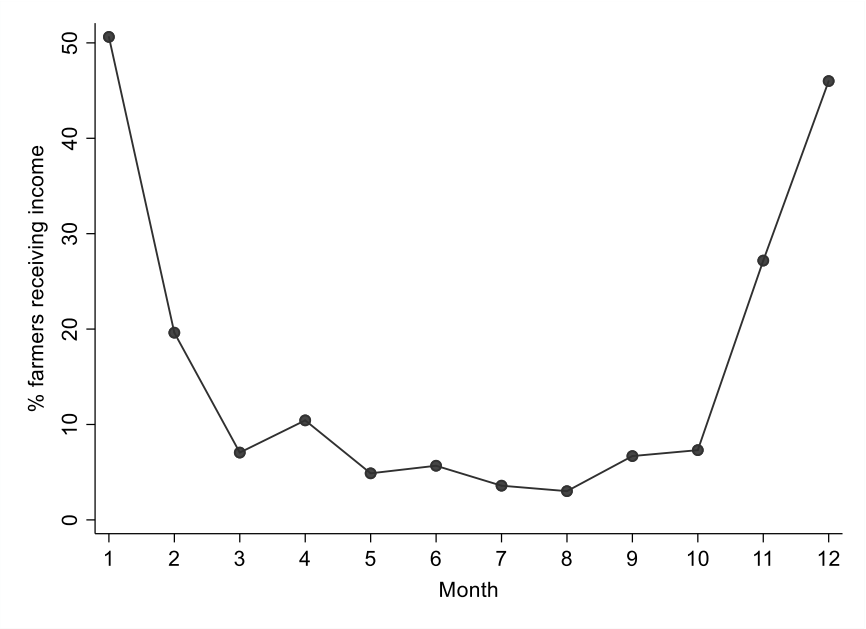
3.1. Poverty & vulnerability

Multiple indicators point to high levels of poverty and vulnerability in target areas.

Agriculture is the main source of income for households; this income is seasonal. About 77% of farmer income in the year prior to the survey was derived from agricultural activities; 13% from livestock, and the remaining 10% from other sources of income (for example full time employment, remittances, etc.). Most households receive most their income in the months of November, December, January and February (see Figure 4). This corresponds to the "Meher" harvest period at the end of the main rainy season. The proportion of households that receive regular income between March and October is low. Vulnerability during this period is highest especially in the months of April through August, when the risk of food shortages peaks. Farmers that generate some income throughout the year are more likely to own and trade livestock and/or to have other (non-agricultural) sources of income. There is also a "Belg" harvest, however, this only makes up a small percentage of the annual harvest and is prevalent only the east of Ethiopia (most sampled Woredas are located in the west), which is a belg-receiving area (UNOCHA 2017; Taffesse et al. 2012). More on this in the 'Agricultural Activities' sub-chapter.

When farmers receive income is relevant for their ability and willingness to pay for crop insurance. It also influences their preferences on when and how premiums should be paid, and in the case of an adverse event, when the insurance should be paid out.

Figure 4. Proportion of households that receive some income in a given month



Households in target areas are cash-strapped. Surveyed farmers reported a median household income of ETB 19,700 per year (approximately USD 680 using current exchange rates), with a median annual income per capita income of about ETB 4,125 (approximately USD 150 using current exchange rates). This corresponds to earnings of a little more than ETB 54 (or USD 1.85 in current terms) per family per day. These estimates are derived from simplified income calculations. During the survey, selected households were asked to estimate their annual household income from various agricultural activities, from livestock and from other sources of income. While these estimates suffer from recall bias, are approximate and cannot be compared to more precise national income and consumption estimates, they do provide an indication of the socio-economic status of households in target areas.

Household income levels can vary significantly from year-to-year due to positive or negative shocks. Data from the survey suggests that in a good year, households can make almost three times more income than in a bad year. Shocks that negatively affect household income are common (see Table 2). An estimated one out of four farmers report facing a shock in the past 12 months, with the most common shocks being the loss of a regular job of a household member (23.1%), crop failure (13.3%) or a serious health problem or death (12.6%). Almost 90% of households report having lost more than half of their crop production at least once over the past five years. This is consistent with an annual crop loss rate of about 13%.

Table 2. Proportion of households experiencing a shock in the past 12 months

Type of Shock	% farmers that experienced a shock in last 12 months
Loss of a regular job of a household member	23.1%
Crop failure	13.3%
Serious health problem or death	12.6%
Widespread death/disease of livestock	5.2%
Increase in prices of the products I buy	4.0%
Serious family conflict	0.9%
Decrease in remittances and support	0.6%
Theft, fire, or destruction of household property	0.5%
Wedding	0.4%
Abandonment or divorce	0.4%
Failure or bankruptcy of business	0.3%
Decrease in prices of the products I sell	0.2%

We estimate non-monetary aspects of poverty in the sample using questions from Ethiopia's most recent Simple Poverty Scorecard.[6] These questions cover the number of household members, male and female literacy rates, the cooking fuel used by the household, the number of mattresses or beds in the household, and radio, gabi and plough ownership. Selected Simple Poverty Scorecard indicators reveal that households in the sample are large, with 5.6 members on average; literacy levels are low, especially for female adults; firewood is the main cooking fuel; the majority of households own a mattress, but only about a third own a radio; and the majority of households own a gabi and a plough (see Table 3).

Table 3. Selected PPI indicators at the household level

Indicator	Sample estimates
Number of household members (#)	5.6
Male literacy (in households with a male husband / male household head)	47%
Female literacy (in households with a wife/ female household head)	19%
Firewood main source of cooking fuel	85%
Owns at least one mattress/bed	65%
Owns a radio or tape player	30%
Owns a gabi	64%
Owns a plough	94%

Combined, these statistics have a number of important implications for the potential roll-out of a crop micro-insurance program:

[6] For more information on the Simple Poverty Scorecard, visit http://microfinance.com/.

- Vulnerability to crop-loss is high, justifying the rationale for crop micro-insurance. Farmer vulnerability to crop loss is high because houshold income depends on income from agricultural activities. On average approximately 80% of a households income comes from agricultural activities (crop farming and livestock holding). Income fluctuates from one year to the next and a high proportion of households have experienced serious crop loss recently (almost 90% of households have lost more than half of their crop at least once over the past five years).

- Farmers are cash-strapped, especially between March and October, and are therefore likely to be particularly price-conscious. The willingness-to-pay analysis confirms this hypothesis.

3.1.1. Key determinants of income and vulnerability

Vulnerability in the sampled Woredas is influened by a number of factors. We discuss five key factors below:

1) Family composition is closely tied to household income levels. On average, larger households in the sample tend to have higher absolute income levels. Larger households own more land; grow more crops; and are less exposed to shocks. One of the main reasons larger households fare better in absolute terms is because they are double-headed. In double-headed households, there are typically at least two income earners, providing a more stable and resilient family environment. Single-headed households are at a much greater risk of a experiencing a shock (+12 percentage points). Female single-headed households, which make up 76% of all single-headed households, face the greatest hardships. They earn about 30% less on average than male single-headed households or double-headed households. While larger households fare better in absolute terms, this is not the case in per capita terms.

2) Households where the main respondent is young (18 to 35) are less vulnerable to shocks. The difference in the vulnerability levels of "young" and "older" households comes from risks associated with the loss of a job or source of income and serious illness/death. An estimated 7% of respondents who were between the ages of 18 to 35 reported that the family experienced a serious illness or death, compared to 15% for respondents who were aged 36 or above. Similarly, 18.5% of young adults reported that their household experienced the loss of a regular job, compared to 25.5% of adults aged 36 or above. There is no difference between respondents of different age groups on questions related to the exposure to serious crop loss.

3) Having attended secondary education or above is associated with higher income levels, but it does not affect vulnerability to shocks. The formal education levels of respondents in the sample are low. An estimated 44% of respondents have never attended any form of schooling; 19% have participated in the informal education system; 25% have attended primary education; while 12% have attended secondary education or above. Outcomes for households in which the main respondent has not attended any formal education or attended primary school only are quite similar. Having attended secondary school or above does however provide a clear signal when it comes to income. Households in which the main respondent has attained secondary education

earn 20% more on average than households where the main respondent has attained primary-level education or below. While the educational attainment of respondents does correlate to household income, we do not observe any signal when it comes to exposure to shocks. In our sample, households in which the main respondent has achieved secondary education or above are equally likely to be exposed to a shock over the past 12 months, compared to households in which the main respondent has not attained secondary-level education.

4) We also observe large regional differences. The sample we work with is not representative at the regional or Woreda level, but it does provide a sense of the span of regional differences. For example, looking at data on exposure to a negative shock to the household over the past 12 months at Woreda level, we find that the proportion of farmers reporting a serious shock ranges from 6.5% in Woredas such as Farta in Amhara, to 59% in Woredas such as Sullulta in Oromia. Similarly, the frequency of exposure to crop loss over the past 5 years ranges from 1.2 shocks over the past five years in Gonji Kolela (Amhara), to three shocks in Seharti Samri (Tigray). Households in different locations face very different realities and sets of risks.

Some of the implications of these statistics for the potential roll-out of a crop micro-insurance program include the following:

- Given how large differences across locations can be, it is important to think of ways to adapt the insurance product and roll-out thereoff to regional and local realities. One could adapt the coverage or premium for example to better reflect the ability of households in a specific location or the type of crop that is covered, but there are other aspects of insurance-design that could potentially be adapted to the local context. For example, the timing of the payments and disbursements, the vector through which payments/disbursements are made, the crops that are covered, the structure of the outreach effort, the level of subsidy provided by location, the branding surrounding the micro-insurance product, etc.

- The insurance is more likely to be unaffordable for those farmers that need it most. Income and vulnerability patterns suggest that households that will be the most able to pay for crop micro-insurance will include double-headed households (where both adults in the household are alive), younger households that are less likely to experience other types of shocks, and the most educated households – due to significantly higher levels of income. Weather shocks are agnostic of the socio-economic characteristics of households, but certain households will be less resilient to crop loss than others and less able to purchase crop micro-insurance. Households that are struggling financially (for example, single-headed households), households that have already experienced a shock in the past or that are at a greater risk of experiencing a shock in the future (for example, "older" households that are at a greater risk of losing a source of income or experiencing a case of severe illness or death in the family), will be less able to sustain payments for crop micro-insurance. In addition, they will also be less resilient to crop loss. Thinking of ways to adjust the payment structure for crop micro-insurance to the reality of certain households might make the product more broadly accessible and acceptable. Potential ideas might include discounted rates for widows or "older"

household heads; or allowing households to skip their full premium payment for one season if they experience a non-covered shock (such as the loss of a family member).

3.2. Agricultural activities

In this section we study three aspects of the context for agriculture in target locations: (i) the agricultural cycle; (ii) the crop-mix; and (iii) the cost of inputs.

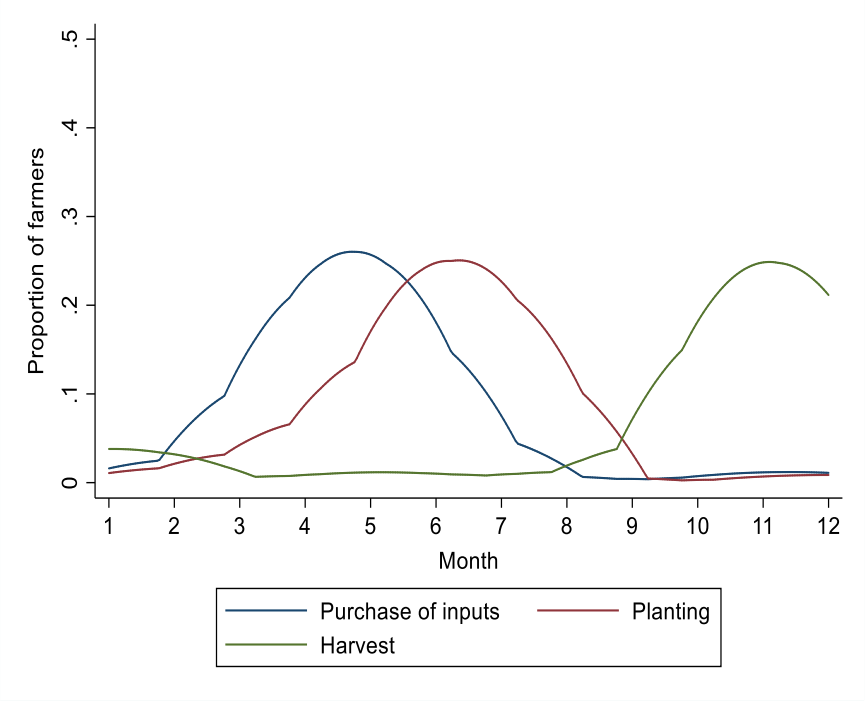
3.2.1. The agricultural cycle

When rolling out crop micro-insurance it is important to keep in mind that separate approaches might be required in the east and west of Ethiopia and that the timing of harvest can differ by location, altitude and crop. Agriculture is all about getting the timing right. Fine-tuning the insurance product in such a way that it has the flexibility to address the slightly different timing needs of different groups of farmers might increase its appeal.

The east of Ethiopia experiences two agricultural seasons, called the "Belg" (June to August) and the "Meher" (October through February); the Western part of the country does not receive the "Belg" rains, and only experiences the "Meher" season. In addition, 95% (2007/08 estimate) of the cereal production is planted and harvested during the "Meher" season (Taffesse et al. 2012). Our sample covers Woredas mostly situated in the western part of the country that do not receive the "Belg" rains. Furthermore, we ask when cereal farmers receive most of their income. Both reasons above explain why we do not detect a strong signal corresponding to the "Belg" harvest.

There are three broad cycles in the agricultural calendar of areas in the western half of Ethiopia: (i) the period during which farmers purchase inputs (March to July); (ii) the planting season, which overlaps with the "Kiremt" rains (April to August); and (iii) the "Meher" harvest period, after the rains (October to February) (see Figure 5 overleaf). As discussed in the previous section, farmers make most of their yearly income during the "Meher" harvest period. Immediately after the harvest, farming families have to spend resources to purchase inputs (seeds, fertilizer, pesticides, etc.) to prepare for the next planting and harvesting season. A shock to household income due to crop loss would immediately impact their ability to prepare for the next season. Ensuring farmers are able to purchase the inputs they need during the March to July period, immediately after the harvest period, is key to their livelihoods. This is the period during which we propose crop micro-insurance will need to kick-in.

Figure 5. Timing of inputs, planting and harvesting for main crop



3.2.2. The crop-mix

The most significant crops for farmers in the sample are teff, wheat and maize (see Table 4 overleaf). Teff is grown by slightly over 60% of farmers and generates about 20% of farmer income. Wheat is grown by about half of the farmers, especially in the highlands, and generates about 16% of farmer income on average. Maize is cultivated by about 60% of farmers and generates about 12% of farmer income. Many farmers also cultivate legumes and vegetables. While these crops do not contribute much to farmer revenues, they are staple foods that are crucial to the diet of farming populations in the target locations. They are also very important for adaptation to climate change.

The crop mix varies significantly by location and altitude; we find that farmers within the same Woredas are likely to cultivate similar crops. The intra-cluster correlation for crop production is high at the Woreda level, meaning that farmers in the same Woredas tend to cultivate a similar mix of crops. Variation in crop cultivation between Woredas explains about 56% of the variation in the teff cultivation, 62% of the variation in wheat production and 64% of the variation in maize production. This means that whether a household grows a certain crop or not is highly dependent on its Woreda. As a point of comparison, the intra-cluster correlation at the Woreda level for level of education is 7%, for exposure to a household shock in the past 12 months 9%, for land ownership 13% and for income about 20%. Certain pairs of crops co-exist in the same location more than others. Woredas that grow teff for example, are also more likely to grow sorghum and sesame; they are less likely to produce wheat, malt and vegetables. Areas that grow wheat also tend to grow more barley, legumes and vegetables; they are much less likely to grow teff, maize, sorghum or coffee. Maize-growing areas are strongly correlated to the production of coffee, khat, banana and fruits.

Table 4. Proportion of farmers that cultivate crops and proportion of annual income derived from those crops

Crop	Cultivates crop	Proportion of annual income from crop
Teff	60.9%	20.4%
Wheat	48.7%	15.8%
Maize	58.9%	12.6%
Legumes	43.3%	6.4%
Malt & Barley	39.1%	5.0%
Fruit	14.9%	4.5%
Vegetables	27.4%	4.4%
Sorghum	26.9%	3.6%
Coffee	8.7%	1.1%
Banana	8.7%	0.8%
Khat	5.2%	0.5%
Sesame	1.9%	0.2%

On average, households cultivate three to four different types of crops; and crop diversity is linked to higher income levels. Only 4% of households in target locations rely on one crop alone; around 20% of households cultivate five or more crops. Households with more members, that are double-headed and that have higher income levels, have a tendency to grow a greater variety of crops.

Despite crop diversity, reliance on cereals is high in surveyed Woredas. An estimated 58% of farmer income is generated from cereals, including teff, wheat, maize, barley and sorghum. This is probably also why we do not find any strong signal linking increased crop diversity to a reduction in the risk of household shocks. The high reliance on cereals justifies the focus of the crop micro-insurance product that is being tested.

3.2.3. The cost of inputs

The purpose of crop micro-insurance products is to ensure that farmers are at least able to meet their input costs for the next season after a negative crop event. Understanding the costs farmers face when purchasing inputs is therefore relevant to the design of such insurance products.

An estimated 92% of farmers in sampled Woredas purchase their inputs. The remaining farmers either mostly produce the inputs they require themselves (6%) or receive them through development programs and initiatives (2%). Input costs consist mainly of expenses related to the purchase of seeds, fertilizer, herbicides, and fungicides and pesticides. In this survey we asked farmers about the costs they incurred for inputs relating to their two main cereal crops, pesticide, herbicide, fungicide and fertilizer.

We find that the median household spends about ETB 2,250 on input costs per year for fertilizer, pesticide, herbicide, fungicide and seeds its two main cereal crops. The largest cost driver is fertilizer, which accounts for slightly more than half of the spend; seeds for the primary and secondary crop combine for about 37% of the cost; finally, herbicides, fungicides and pesticides contribute to about 10% of the total annual cost of inputs for the two primary crops. On average households have 2.4 cereal crops, so we are slightly underestimating the total input

costs by only taking into account the costs of the primary and secondary cereal seeds. We do not have sufficient statistical power to breakdown costs by crop. However costs associated with wheat production in particular appear to be the highest. We also find that farming households that have more members, higher levels of education and higher income levels spend significantly more resources on input costs.

In this study we are testing WTP for drought and hybrid insurance products at two different coverage levels: ETB 2,000 and ETB 4,000. Based on the input cost-estimates obtained we find that a coverage level of ETB 2,000 would cover the costs of about 38% of farmers, a coverage of ETB 3,000 would cover the costs of about 64% of the farmers, while a coverage of ETB 4,000 would cover the costs of about 77% of farmers. The least covered farmers would be wheat producers:

- At a coverage level of ETB 2,000, an estimated 22% of wheat producers[7] and 26% of barley producers would be covered, compared to34% of teff producers, 44% of maize producers and 47% of sorghum producers;
- At a coverage level of ETB 3,000, an estimated 49% of wheat producers and 55% of barley producers would be covered, compared to 63% of teff producers, 67% of maize producers, and 71% of sorghum producers;
- At a coverage level of ETB 4,000 an estimated 64% of wheat producers and 70% of barley producers would be covered, compared to 76% of teff producers, about 80% of maize producers and 88% of sorghum producers.

A number of important insights to keep in mind for the design of the crop micro-insurance include:

- Different crops have different input cost levels. Wheat farmers need higher coverage levels on average than sorghum or maize farmers. One hypothesis to consider is that one of the key success factors of the crop micro-insurance product might be sufficient differentiation in coverage levels for the insurance product to address the needs of different types of crop farmers.
- The ETB 4,000 coverage option provides a much more comprehensive coverage for farmers. It is self-evident that the ETB 4,000 option would provide double the coverage of an insurance product with a coverage of ETB 2,000. We find that the risk of going with the ETB 2,000 option is that it simply does not cover the needs of a majority of farmers, especially if the compensation is partial. There is an important trade-off to consider in the design of the micro-insurance product between its affordability for farmers and its ability to fully mitigate crop production risk.

Finally, it is also important to take into consideration the general equilibrium effects of crop micro-insurance on the prices of inputs. A large-scale roll-out of the crop micro-insurance product might impact the price of key inputs, including seeds, fertilizer, pesticides, herbicides and fungicides in the aftermath of a covered shock. If the cash-injection following a shock

[7] Farmers are considered producers if they report growing the crop.

increases the price of key inputs for farmers, this might undermine the very purpose of the insurance product.

3.3. Risk perceptions, coping and mitigation strategies

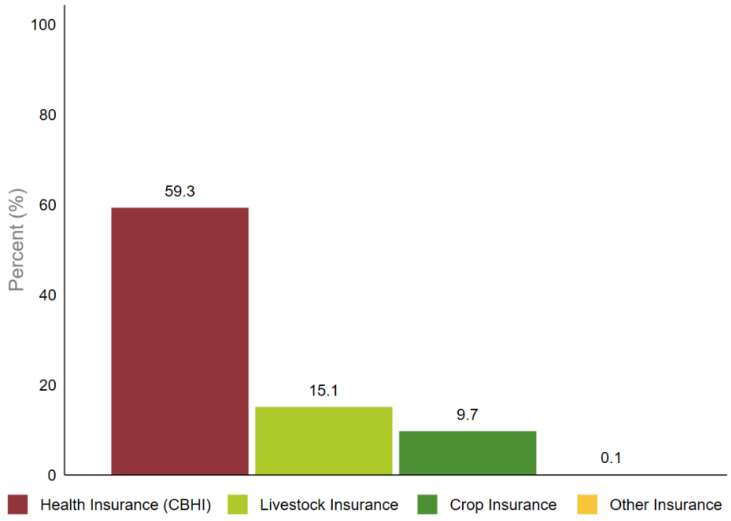
Ethiopians have long been accustomed to Iddir, a home-grown form of community-based insurance that is ubiquitous in Ethiopia. Iddir is an informal risk pooling mechanism amongst community members. Community members form a funerary association to pool resources for use in cases of emergency, mainly the death of a member and related funeral costs. The Iddir mechanism is deeply engrained in Ethiopian society. An estimated 81% of households in our sample participate in an Iddir group.

Iddir inspired the creation of the more recent Community-Based Health Insurance (CBHI) initiative, designed to provide universal health care coverage in Ethiopia. The initiative, launched in 2010, has been a success, with a majority of households in our sample reporting access to health insurance under CBHI (see Figure 6). An estimated 59% of households in sampled Woredas reported having access to health insurance. The CBHI initiative covers the basic health care costs of households at local health care centers in exchange for payments into a collective fund. CBHI is based on risk pooling and has been strongly promoted by the government in pursuit of national health insurance coverage. Households contribute an annual premium of about ETB 240 to CBHI, plus additional payments for adult children (Lavers 2019). This premium covers the entire family. This is an important price point to consider as a comparison for crop insurance, as it anchors expectations of what insurance costs and it provides a strong signal about the ability of households to pay for insurance at a level of ETB 240 per year.

Participation in CBHI is very strongly correlated to participation in an Iddir association. Households that participated in an Iddir were 21 percentage points more likely to also participate in CBHI. Dercon et al. (2011) run a field experiment in which the use different interventions with regards to marketing weather-based index insurance to Iddirs and find that groups in which leaders are provided with group-focused training, the uptake of the insurance product is higher. Based on econometric analysis, we find that there is no significant correlation between the WTP and Iddirs. This means that Iddirs do not influence the WTP levels of households.

Another strong predictor of health care coverage is age. Health insurance coverage increases from age 20 through to age 65, but decreases thereafter. For adults below the age of 30, health coverage was 47%; it increases to 57% for adults from ages 30 to 39; then peaks at about 65% of adults from ages 40 through to 65, before dropping to about 50% after the age of 65.

Figure 6. Percentage of households with access to various types of insurance (%)



Outside of Iddir and CBHI, few households have access to other insurance products, covering either livestock or crops. An estimated 10% of farmers reported having some form of crop insurance coverage. All farmers who reported having some form of crop insurance were also part of an Iddir. This might suggest that existing Iddir structures have been extended to also support members in the case ofother losses, but we are not able to confirm this using existing data. Many of the livestock insurance are based on risk-pooling between community members.

In the absence of insurance policies, households have to revert to coping and mitigation strategies to manage the risks they face with respect to crop loss. Households mitigate in a variety of ways: 36% of households report diversifying income outside of crop farming, 32% of households rotate their crops, 29% keep savings, 92% diversify their crops[8] and about 16% plant trees. When shocks do occur, the main coping strategy involves selling assets (including livestock). An estimated 52% of households would sell assets after a financial shock; 22% of households would reduce expenditures; and a further 20% would consider taking out a loan.

[8] Diversification of crops is defined as having two or more different crop types.

4. Willingness to Pay

This section illustrates the analysis and the findings on willingness to pay (WTP) for the two types of insurance products covered by our research: drought and hybrid insurance. First, we discuss some limitations of the analysis. Secondly, we assess whether the groups of farmers offered different rates and coverages are comparable. Thirdly, we present the results on the WTP as a function of coverage, price, and type of insurance. Fourthly, we analyse whether other socio-demographic factors are associated with WTP. Finally, we attempt to identify the characteristics of the farmers who are willing to pay a viable rate.

4.1. Limitations of the analysis

A number of limitations call for some caution in the interpretation of the results. These limitations are discussed in this section.

The micro-insurance sector is an infant industry in Ethiopia (Amha et al. 2012). As a consequence, farmers' experience with crop micro-insurance in Ethiopia is limited. This implies that their familiarity with the way insurance works is limited. While pre-screening and questions to test respondents' understanding of the insurance may partially solve this problem, there is still the risk that some farmers do not fully understand insurance and its underlying concepts such as coverage and premium rates.

There is a risk of 'anchoring', where a given answer is inadvertently influenced by a question that is asked earlier in the survey. This may in particular affect the declared WTP for the hybrid insurance, as the question comes after the WTP question for drought insurance. Farmers may be reluctant to accept the WTP for the hybrid insurance if its randomly prompted price is much higher than the randomly prompted price for the drought insurance. This would imply a positive association between the drought rate and the WTP for the hybrid insurance. Secondly, farmers may have a virtual budget constraint in their mind, thus committing to buy the drought insurance at a higher rate may make them less willing to also buy the hybrid insurance. In this case, the bias would go in the opposite direction, meaning it would lead to a negative association between the drought prompted rate and the WTP for the hybrid insurance.

The statistical power is limited. Some estimates may present too much variation to reach a conclusion on whether the WTP for two different groups is statistically significant. In commenting on the results, we also specify whether an observed difference is statistically significant, based on a conservative approach to calculating confidence intervals.

The WTP we estimate may be contingent on specific survey and contextual characteristics. For example, these could include the time of the year during which the survey took place and the related meteorological conditions, and the way in which the enumerators presented the products. This could mean that a similar survey administered in a different period of the year with a slightly different approach may reveal a different average WTP for similar products. Some of the survey characteristics (such as the recent meteorological conditions) may potentially also affect different groups of respondents in different ways.

There may be a difference between stated and actual preferences. It is very difficult to estimate the extent to which the declared farmers' WTP would translate into the actual demand for the proposed insurances. Ideally, the findings from this analysis should be benchmarked against some indicators of actual or revealed preferences – derived from real market choices - to understand the magnitude of the possible bias.

4.2. Assessment of whether groups are comparable

Before stepping into the analysis, it is important to ensure that groups of farmers prompted with different coverages and rates are fully comparable. Given that surveyed farmers are randomly allocated to i) the insurance products with either an ETB 2,000 or ETB 4,000 premium coverage, and ii) to a premium rate group, we expect that the average characteristics of the respondents to be very similar across the resulting groups.

While some minor differences may occur by chance, general inter-group homogeneity confirms that the randomisation worked as expected. This in turn ensures that the results are fully comparable across groups, and rules out the risk that the results are biased by the different group composition. To test this assumption, we compared the averages of the main variables of interest across groups.

The comparison across the two premium coverage groups – ETB 2,000 and ETB 4,000, respectively - confirms that the two groups are fully comparable. Although there are some small differences between the two premium coverage groups, these are fully compatible with the within-group variation of the variable and are not statistically significant.

Farmers allocated to different premium rates groups are, on average, also similar across these groups. The premium rate groups are composed of farmers who were prompted with different rates for the same coverage and type of insurance. Few statistically significant differences emerged, and this is not unexpected given the large number of pairwise differences tested, and the relatively small average sizes of these groups.

4.3. Findings on willingness to pay as a function of coverage, price and insurance type

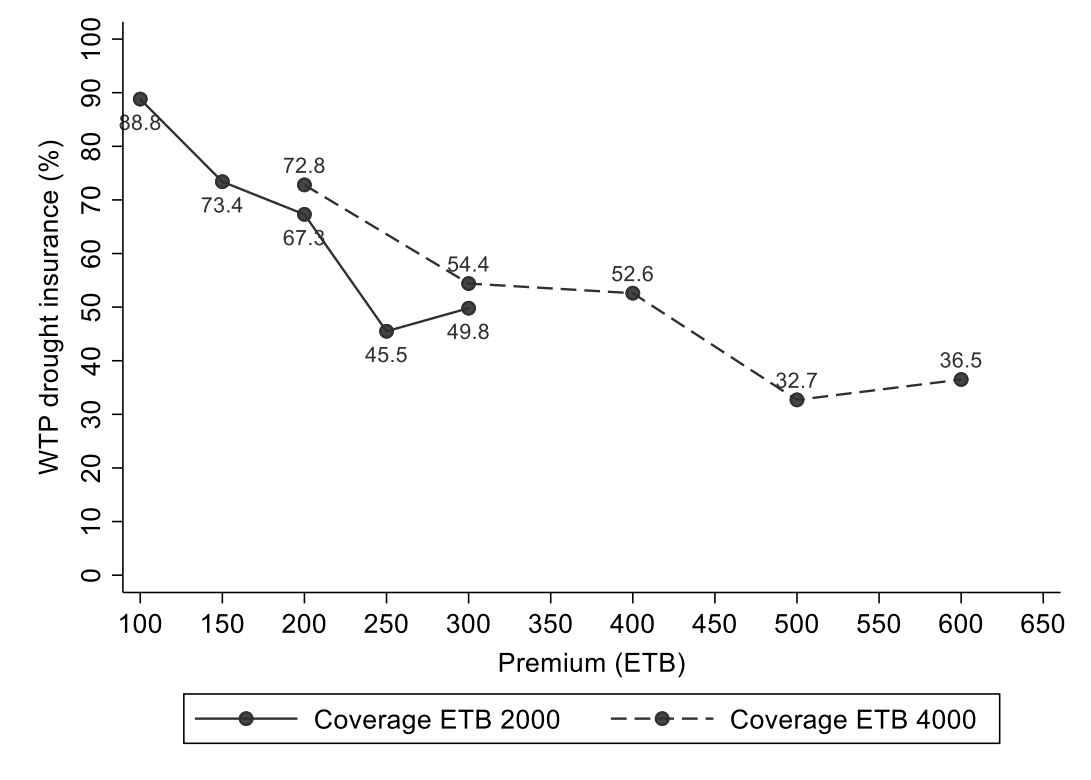
4.3.1. Results for drought insurance

Farmers are price sensitive for both drought insurance products (for a coverage of ETB 2,000 and ETB 4,000). The demand curve in Figure 7 depicts the association between the insurance premiums that were tested and the percentage of farmers that were willing to pay at a given premium rate. We can see that the WTP decreases quickly with relatively small changes in price. For the drought insurance product with a coverage of ETB 2,000, the WTP decreases from 89% of farmers for a premium of ETB 100, to an estimated 50% of farmers for a premium of about ETB 300. We observe similar patterns for the drought insurance product with a coverage of ETB 4,000, where WTP drops from 73% for a premium of ETB 200, to about 37% for a premium of ETB 600.

It is interesting to note that the steepest decline in WTP occurs between the ETB 200 and ETB 250 mark, which includes the price point of the CBHI health insurance premium (ETB 240).

From a premium of ETB 150 to ETB 200, the drop in WTP for the drought insurance product with a coverage of ETB 2,000 was about 6 percentage points; from ETB 200 to ETB 250, the drop in WTP was about 22 percentage points; and from ETB 250 to ETB 300 there is a slight (and non-significant) increase in WTP. One possible explanation for this large drop in WTP observed between ETB 200 and ETB 250 is that CBHI is priced at ETB 240 per family per year and that farmers are anchoring at this price point. During the design phase for the product it is important keep in mind how the pricing of other insurance offerings might impact the pricing and structure of micro crop-insurance.

Figure 7. The demand curve for drought insurance



Farmers are only willing to pay a slightly higher premium for double the insurance coverage; this suggests that rather than considering the rate (premium over coverage) farmers consider the affordability of the premiums they are shown. This can be seen by comparing the number of farmers willing to pay for the two different drought insurance products at an absolute premium of ETB 200 and ETB 300 (see Figure 7 and

Table 5). The ETB 200 and ETB 300 price points were tested for both drought insurance products. Moreover, as shown above, the two populations that were asked their WTP for either the ETB 2,000 and ETB 4,000 drought insurance coverage are similar. Comparing WTP levels for the two drought insurance products at these price points, we find that the proportion of farmers willing to pay for drought insurance is almost the same, irrespective of coverage. For a price point of ETB 200, 73% of farmers are willing to purchase the insurance product with a coverage of ETB 4,000, compared to 67% for the ETB 2,000 coverage; a difference of just 6 percentage points. At a price point of ETB 300, 54% of farmers are willing to purchase the ETB 4,000 coverage, compared to 50% for the ETB 2,000 coverage. These differences are not statistically significant in the context of this sample.

Table 5. Average values across overlapping shown premiums

Premium by insurance type	Willingness to pay (%)	
	ETB 2,000	ETB 4,000
Drought Insurance – ETB 200	67	73
Drought insurance – ETB 300	50	54

Note: Weighted averages.

The WTP for the drought insurance product at a commercially viable rate is higher than anticipated:

- Approximately 50% of farmers are willing to pay the commercially viable rate (ETB 300 or 15%) for drought insurance with a coverage of ETB 2,000, with a margin of error of about +/- 12 percentage points.
- About 37% of farmers are willing to pay the commercially viable rate (ETB 600 or 15%) for drought insurance with a coverage of ETB 4,000, with a margin of error of about +/- 18 percentage points.

Table 6. Share of respondents willing to buy the drought insurance product by premium rate and coverage

Premium rate (%)	ETB 2,000			ETB 4,000		
	Mean	Confidence interval 95%		Mean	Confidence interval 95%	
5%	89	81	96	73	62	83
7.5%	73	61	85	54	38	70
10%	67	55	80	53	40	64
12.5%	46	26	65	33	20	46
15%	50	38	63	37	19	55

Note: Weighted averages.

It is also important to note that because farmers declare to be willing to pay a given rate does not guarantee that they would actually buy the insurance when the product is sold on the market. While it is virtually impossible to overcome this hurdle with a survey, we tried to partially account for this caveat by asking farmers how likely they would be to buy the product for the price they are willing to pay, when the insurance product is sold on the market.

Most farmers declared that they would certainly or most likely buy the product when it is sold on the market for the price they declared to be willing to pay. For drought insurance with the ETB 2,000 premium coverage, 52% would certainly buy the insurance; 36 % would most likely buy it and 12 % would probably not buy the product. For drought insurance with a ETB 4,000 premium coverage, 50% would certainly buy the product, 41% would most likely buy the product and 9% would probably or certainly not buy the product. There is no relationship

between the WTP a specific premium and the likelihood that a farmer will buy the product. Farmers with a WTP for higher premium rates are not less likely to pay.

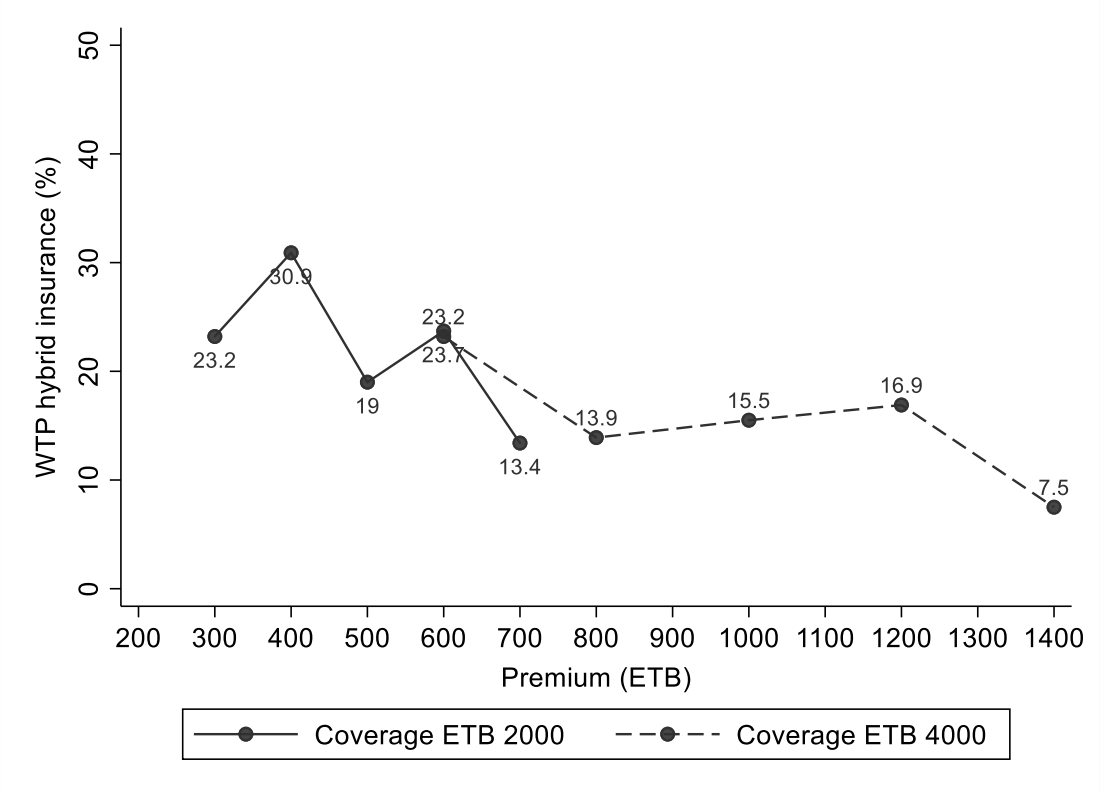
It is also important to note that the findings are limited to **farmers'** *initial* WTP for drought insurance, as evidence from Ethiopia suggests that it may decrease over time. For example, Vargas et al. (2011) found that out of all 100 farmers initially willing to pay, 88 are still willing to pay if there is no payout in the first year, and 79 are still willing to pay if there is no payout after five years. They found that the largest driver of WTP is basis risk: of the farmers initially willing to pay, only 70 % are willing to pay in the following year if there were no rains on their land (and they experienced crop loss as a consequence), but they did not receive a payout.

4.3.2. Willingness to pay for hybrid insurance

For hybrid insurance, WTP is low and there is no significant difference in WTP between the different premium rates (see Figure 8. The demand curve for hybrid insurance). WTP for hybrid insurance is lower for higher price points, but the decrease in WTP for small increments in price is less acute than in the case of drought insurance. This is partly explained by the fact the hybrid insurance is more expensive than drought insurance, hence is more unaffordable for most farmers. A closer look at the data however reveals that this is not the only explanation and that price-anchoring is playing an important role in determining the WTP of farmers for hybrid insurance.

In this sub-section we explore some of the similarities and differences with drought insurance and explain why it is important to interpret these results cautiously.

Figure 8. The demand curve for hybrid insurance



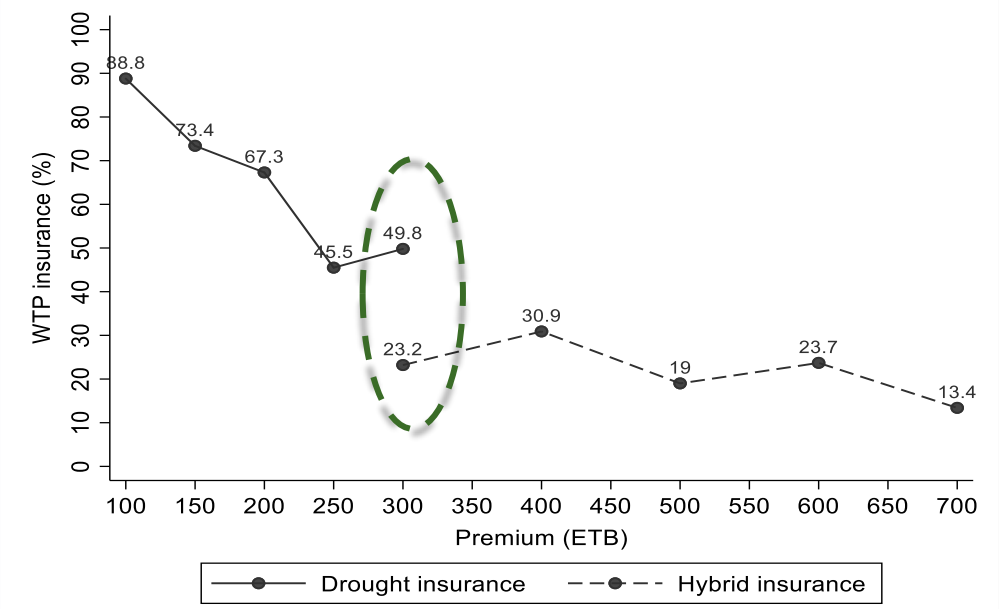
Similarly to drought insurance, farmers are not willing to pay a higher premium for double the coverage. When comparing the two hybrid insurance products at similar price points, we again find that farmers are not willing to pay more for a much higher coverage. For a premium of ETB 600, we find that 23% of farmers would be willing to purchase the hybrid insurance with a coverage of ETB 4,000, compared to 24% who would be willing to pay for the coverage with ETB 2,000. This seems to confirm that farmers either: farmers are much more conscious of the price point than the benefits of the insurance product; or that farmers do not fully understand the benefits of additional coverage as explained to them during the survey.

Two sets of inconsistencies suggest that anchoring effects are high and are determining WTP levels for the hybrid crop insurance product. Due to sample size constraints, it was decided that we should ask all farmers in the sample about their willingness to pay for both drought and hybrid insurance. Questions about hybrid insurance came after WTP questions about drought insurance. To test WTP for both the drought and hybrid insurance products, farmers were asked whether they would be willing to pay for each insurance product at a random price point (premium). Since hybrid insurance is a qualitatively superior product for the same level of coverage, we ensured that the random price point that was asked of farmers for the hybrid insurance was always higher than the random price point asked for the drought insurance product.

The first inconsistency is that while the majority of farmers prefer the hybrid insurance product to the drought insurance product, they are less willing to pay for it. When asked which of the two products farmers preferred, an estimated 84% of farmers reported that they prefer the hybrid insurance product. This makes sense, since hybrid insurance offers a much more comprehensive coverage than drought insurance. However, for a similar price point of ETB 300, 50% of farmers are willing to pay for drought insurance product with a coverage of ETB 2,000, but only 23% of farmers are willing to pay for a much better hybrid insurance with the same coverage (see

Figure 9). We attribute this very large drop in WTP to the jump in price between the drought and the hybrid insurance product. This pattern again confirms the price-sensitivity hypothesis and that farmers seem to be most concerned about affordability and not coverage.

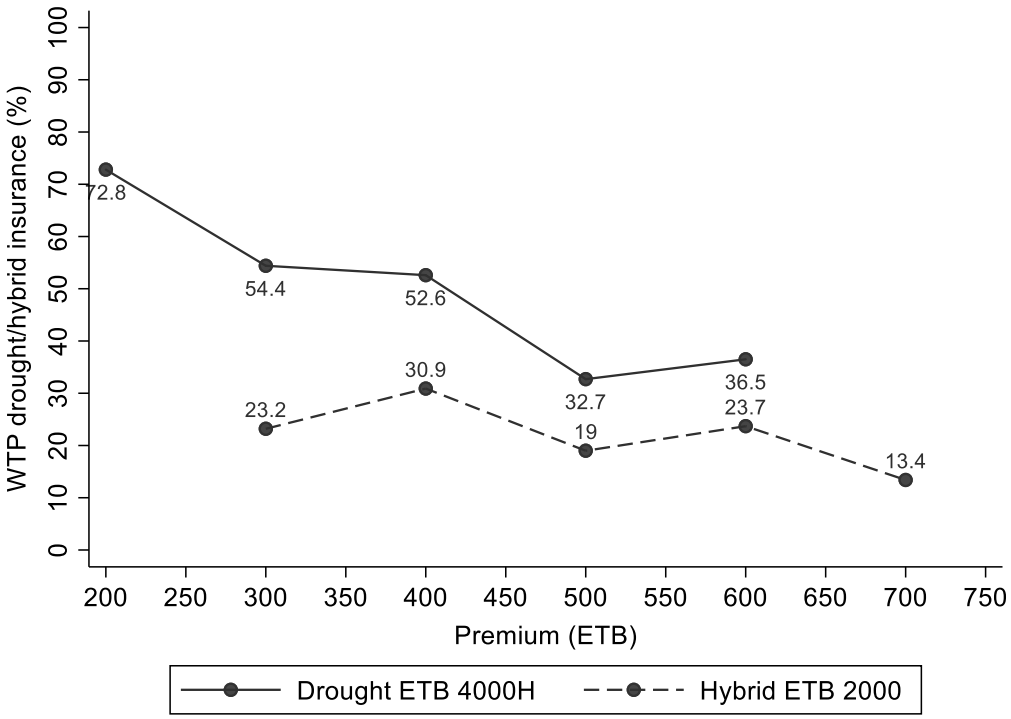
Figure 9. Demand curve for drought and hybrid insurance (coverage of ETB 2,000)



The second inconsistency is that while farmers do not value higher coverage, WTP for the drought insurance product with a coverage of ETB 4,000 is much higher than WTP for hybrid insurance with a coverage of ETB 2,000. For both the drought and hybrid insurance products, we showed that at the same price point willingness to pay did not increase with coverage. Yet when comparing the drought insurance product with a coverage of ETB 4,000 to the hybrid insurance product with a coverage of ETB 2,000 at similar price points, we find that WTP is about 20 to 30 percentage points higher for the drought insurance (see Figure 10). At face value this would seem to suggest that farmers prefer the value of the coverage to the breadth of the coverage. This is inconsistent however with both findings on how much farmers are willing to pay for a higher coverage amount and their stated preference for the hybrid product. Again, we attribute this inconsistency to anchoring and the jump in price points between the WTP questions on drought insurance and the WTP questions on hybrid insurance.

These findings suggest that we cannot interpret WTP results for hybrid insurance to accurately **reflect farmers' willingness to pay for the hybrid insurance product**, which has important implications for how the insurance products are marketed and presented to farmers. We are working under the assumption – provided by Kifiya and GGGI - that the commercially viable premium rate for hybrid insurance is 25% of the coverage amount. At that rate, we estimate that 19% of farmers would be willing to pay for the hybrid insurance product with a coverage of ETB 2,000 (+/- 11 percentage points) and 16% for hybrid insurance product with a coverage of ETB 4,000 (+/- 7percentage points). However, we cannot assume these to be accurate reflections of willingness to pay for hybrid insurance, since these estimates are lowered by a clear anchoring effect. The sheer size of the anchoring effect suggests that when presenting several insurance products to households in rural areas there is a real risk that they would go for the cheapest insurance option, not the best option.

Figure 10. Demand curve for drought (ETB 4,000) and hybrid (ETB 2,000) coverage



The fact that farmers declare to be willing to pay a given rate does not guarantee that they would actually buy the insurance when the product is sold on the market. For hybrid insurance, we find a similar likelihood to buy as for drought insurance. The majority of the households reported that they will certainly (43%) buy the hybrid insurance product at a price point that they accept; 46% mentioned that they would probably buy the product, while the remaining 11% said they would probably not purchase hybrid crop micro-insurance.

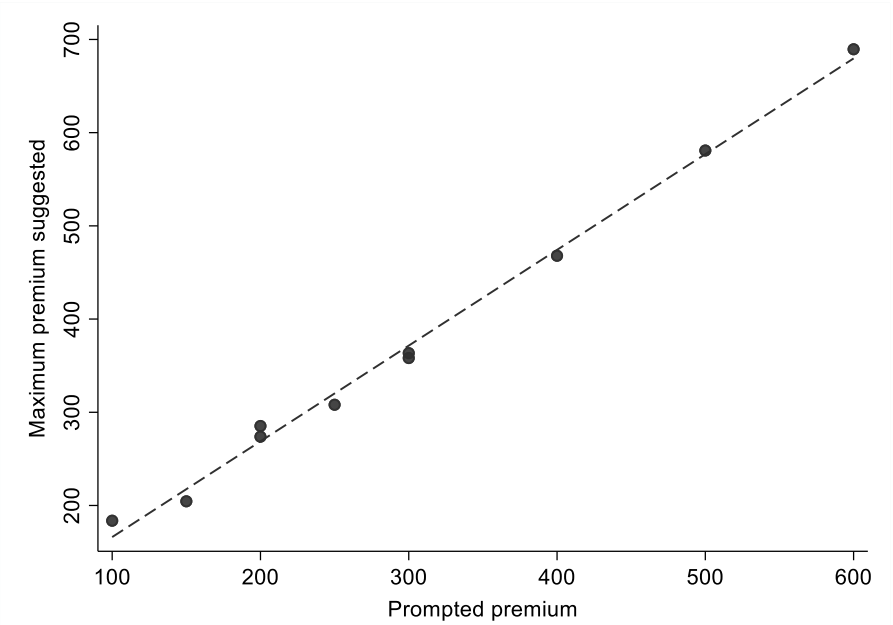
4.3.3. What can we learn from the open-ended willingness to pay questions?

As part of the willingness to pay questions, farmers were first asked whether they would purchase a given insurance product at a randomly selected price point. If they accepted the shown price, they were then asked what the maximum price they were willing to pay was for the crop micro-insurance product. If they rejected the shown price, they were instead asked if there was a lower price point that they would accept.

The open-ended questions confirm that there is anchoring. We first focus on the case of farmers that were willing to pay for drought crop micro-insurance at the randomly selected price point. For this group of farmers, we find that the randomly selected price point is predictive of the maximum premium they are willing to pay for the crop micro-insurance. There is a very strong linear association between the randomly selected premium farmers were asked about, and the maximum premium they were willing to pay (see Figure 11). On average, the maximum farmers are willing to pay is about ETB 70 higher than the prompted rate. This means that in relative terms, the maximum farmers are willing to pay decreases exponentially as the

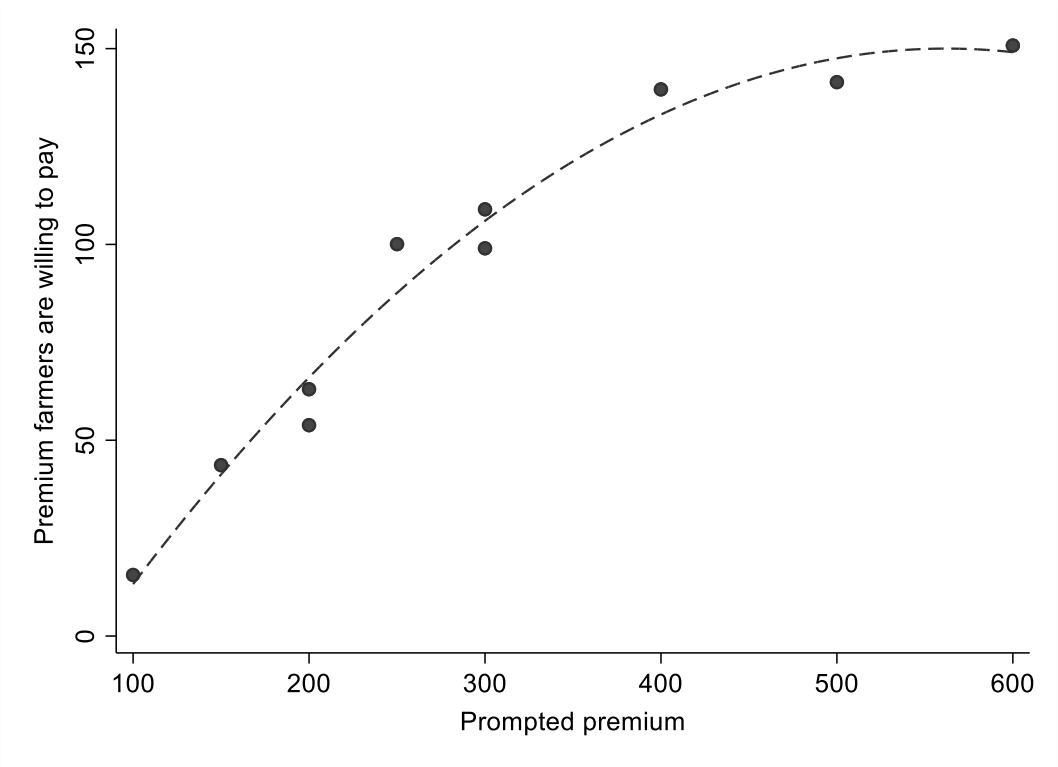
prompted premium increases. For a randomly prompted rate of ETB 100, farmers that were willing to pay ETB 183 for the drought insurance product with a coverage of ETB 2,000; this corresponds to an increase of 83 percentage points. For a randomly prompted rate of ETB 600, farmers were willing to pay a maximum premium of ETB 689 for the drought insurance package with a coverage of ETB 4,000; this is 15 percentage points higher than the prompted premium.

Figure 11. Prompted premium versus maximum premium suggested for farmers that were willing to pay for crop insurance at the tested price point (for both drought insurance products)



We find similar patterns for farmers that were not willing to pay for drought micro-insurance at the randomly selected price point. For this group of farmers (40%), we find that the randomly selected price point is predictive of the lower price that farmers suggest they would be willing to pay for the insurance product. The association is also strong and positive (see Figure 12). The higher the prompted premium, the higher the (lower) price at which farmers would be willing to purchase the insurance product. This holds true up to a certain threshold. It appears that farmers that are not willing to purchase crop insurance at the prompted rate are also not willing to pay more than ETB 150 for the insurance product, regardless of the coverage rate. This appears to be an important psychological price point to keep in mind when we determine the coverage and premium rate of the drought insurance product.

Figure 12. Prompted premium versus premium suggested for farmers that were not willing to pay for crop insurance at the tested price point (for both drought insurance products).



These patterns reveal a high level of price-anchoring and imply that we cannot use the open ended questions to measure willingness to pay at a certain price point, without first adjusting for the randomly prompted rate that was used.

The open-ended questions on WTP do provide us with some additional information on how much a farmer is able or unable to pay for the crop insurance product. We exploit this information in the next sub-section to learn more about the determinants of WTP, controlling for the randomly prompted rate.

4.4. Socio-economic determinants of willingness to pay

Beyond rate and coverage, socio-demographic factors may also be associated with WTP for insurance products. The information collected in the survey allows us to explore the role played by a wide set of variables. In this section, we focus the analysis on willingness to pay for drought insurance, since it is not affected by the same anchoring issues as the hybrid insurance package.

Econometric analysis reveals the following:

- Household income levels are the strongest predictor of willingness to pay for drought insurance. Households in the highest income quintile are about 17 percentage points more likely to purchase crop insurance compared to households in the lowest income quintile. Evidence suggests that the effect of income becomes stronger for higher absolute premium rates. The higher the premium of the insurance product, the greater

the barrier for low income households. This suggests that if the premium becomes to high it is no longer affordable for households in the lower income quintiles.

- Age appears to be a strong predictor of willingness to pay. Younger respondents were more likely to be willing to purchase drought micro-insurance and were willing to pay more for it. The willingness to pay of young adults aged 18 to 34 is on average 6 percentage points higher than adults aged 35 to 49; 10 percentage points higher than respondents aged 50 to 64; and finally 15 percentage points higher than respondents aged 65 or above. This might be because younger respondents have a better understanding of what insurance is, or are more inclined to explore new products. We are not able to offer a convincing interpretation on the basis of the available data.

- The type of crop seems to matter: evidence points to lower willingness to pay for drought insurance levels amongst maize farmers. Farmers for whom the primary crop is maize are almost 15 percentage points less likely to be willing to purchase drought insurance at the randomly selected price point. We also find that the proportion of household income that comes from maize is associated with a drop in willingness to pay (as per the open WTP question). While we cannot exclude the fact that this correlation is spurious, maize is known to be a more drought resistent crop. This might lead farmers to be less willing to pay for crop insurance.[9] As a consequence, the roll-out of the product could initially target farmers with crops that are more vulnerable to drought. However, its important to keep in mind that insurance companies require diversification to prevent insolvency.

- Farmers with health insurance are willing to pay more for drought insurance. Evidence from the open-ended WTP question suggests that farmers with health insurance are willing to pay on average ETB 30 more for drought insurance than farmers without health insurance. This can be a consequence of familiarity with insurance or a sub-group of individuals that has a higher risk aversion, comparatively speaking.

- Geographic variation in willingness to pay (WTP) levels is high. We do not have sufficient precision to report results by Woreda or by Region, but econometric analysis reveals some relevant patterns. WTP at the Regional level does vary, but differences between Regions are not statistically significant when controlling for the price point that farmers were asked about. The fact that differences are not statistically significant, does not mean differences between Regions are small; rather it means that we do not have enough statistical power to identify Regional differences and that within-Region variation in this case is quite high. We estimate that WTP in Tigray is 3.5 percentage points higher than in SNNPR; 7 percentage points higher than in Amhara; and about 17 percentages points higher than in Oromia. The standard error of these estimates is about 8 percentage points. It is also important to keep in mind that this sample only includes few Woredas per Region, which means that Woreda level idiosyncrasies could be driving the regional differences we observe.

  While differences average-out at the regional level, we observe a lot more variation in the WTP at the Woreda level. These differences hold when we include other controls,

[9] In a spurious correlation, there is a third variable that is correlated to the two variables for which causality or correlation is established, i.e. there may be a third variable that explains the correlation between maize and WTP.

for example age, gender, poverty levels, crop mix and the presence or not of health insurance. It is not surprising to find a high degree of geographic variation in willingness to pay, since different locations have different characteristics.

While large we anticipate large geographic differences in the take-up of crop micro-insurance, we do not advise to use findings from this study to establish differential pricing by Region or Woreda. Much more reliable information on WTP will be obtained once these products are piloted in the field under real conditions.

The patterns discussed above are relevant for the better targeting of the micro-insurance products. We anticipate a higher willingness to pay from households with greater income levels, younger households and households that have already been exposed to other types of insurance, in particular health insurance. The importance of income in the ability of households to access the crop insurance product will depend on the premium rate. Finally, more research needs to be done to confirm whether indeed maize farmers are much less likely to be willing to purchase drought insurance.

4.5. Design preferences

During the survey farmers were asked about design preferences with respect to insurance products, the timing of the payments and their interest in potential loans to pay for the premiums. The take-aways from this set of questions include:

- When asked which of the two insurance products they preferred, the majority of farmers (84%) selected the hybrid insurance package. This is not surprising, since the hybrid insurance product – at a similar price and with a similar coverage level – is a qualitatively better insurance product.

- This finding is consistent with the external shock that farmers are concerned about the most: diseases. When asked which was the primary shock they would choose to insure themselves against - options included drought, diseases, flooding and hail - an estimated 46% of farmers picked crop-related diseases, compared to 39% who picked drought and 12% who picked flooding. Farmers that were most concerned about drought were more likely to prefer the drought insurance product and were more willing to pay for drought insurance.

- We find that the price-point is the strongest predictor of whether a farmer will purchase an insurance product, not whether they prefer the drought or hybrid insurance packages. It is important to remember that an expressed preference for the hybrid insurance product does not imply that farmers would be more likely to purchase hybrid insurance over drought insurance. Farmers are very price conscious. Willingness to pay is determined more by the affordability of the product, than the added value of some of the features the insurance product provides.

- The majority of farmers (90%) would prefer payments to be made during or directly after the harvesting season. We have shown that this is the period when farmers make most of their income; this is also the period when they need cash the most, in order to purchase the inputs they require for the next planting and harvest season.

- An estimated 42% of farmers expressed interest in taking-up a loan from an MFI to pay for crop micro-insurance. Farmers were asked about their interest in potential loan providers, to support the purchase of a crop micro-insurance. Slightly more than 10% of farmers expressed interest in seeking a loan from a RuSACCO and 42% from an MFI. An estimated 45% of households expressed not being interested in taking out a loan. The most common reasons included expecting the interest rate to be too high and requiring more information.

- Willingness to take out a loan was significantly lower amongst farmers that were also willing to pay for crop insurance at the randomly selected price point On average 33% of farmers who were willing to purchase drought insurance, also expressed an interest in a loan from an MFI to help pay for the premiums. This compares to 50% of farmers who were not willing to pay for crop insurance at the random price point they were shown. This suggests that farmers that cannot afford the premium, might consider the option of a loan to pay for the crop insurance scheme.

5. Concluding Remarks

In this concluding section we summarize some of the main insights from this study and discuss implications for the design and rollout of the drought and hybrid crop insurance products.

5.1. Poverty and vulnerability

Households in target areas are cash-strapped and vulnerable. Surveyed farmers reported a median household income of ETB 19,700 per year (approximately USD 680 using current exchange rates), with a median annual income per capita of about ETB 4,125 (approximately USD 150 using current exchange rates).

Household income levels can vary significantly from year-to-year due to positive or negative shocks. Shocks that negatively affect household income are common. An estimated one in four farmers reported facing a shock in the past 12 months, with the most common shocks being the loss of a regular job of a household member (23.1%), crop failure (13.3%) or a serious health problem or death (12.6%).

Vulnerability in the sampled Woredas is influened by a number of factors. Five key factors include:

- Family composition. Single-headed households are at a much greater risk of a experiencing a shock (+ 12 percentage points). Female single-headed households, which make up 76% of all single-headed households, face the greatest hardships.
- Age. Households where the main respondent is young (18 to 35) are less vulnerable to shocks. The difference in the vulnerability levels of "young" and "older" households comes from risks associated witht the loss of a job or source of income and serious illness/death.
- Education. Having attended secondary education or above is associated with higher income levels, but it does not affect vulnerability to shocks.
- Geography. We also observe large geographic disparities in vulnerability and poverty levels.

Some of the implications of these statistics for the potential roll-out of a crop micro-insurance program include the following:

- It is important to think of ways to adapt the insurance product to regional and local realities. There might be elements of the insurance product that by design cannot be localized, but there are other aspects that potentially could be adapted to the local context. For example: the timing of the payments and disbursements, the vector through which payments/disbursements are made, the crops that are covered, the structure of the outreach effort, the level of subsidy provided by location, the branding surrounding the micro-insurance product, etc.

- The insurance is more likely to be unaffordable for those farmers that need it most.Households that are struggling financially or are at a greater risk of experiencing a shock in the future, will be less able to sustain payments for crop micro-insurance and

less resilient to crop loss. Thinking of ways to adjust the payment structure for crop micro-insurance to the reality of certain households might make the product more broadly accessible and acceptable. Options might include discounted rates for widows or "older" household heads; or allowing households to skip their full premium payment for one season if they experience a non-covered shock (such as the loss of a family member).

5.2. The context for agriculture

Agriculture is the main source of income for household in target areas. This income is seasonal and follows the timing of the "Meher" cycle: the purchase of inputs occurs during the months of March to July; planting happens from April to August; and the harvest period spans from October to February.

The most important crops for farmers in the sample are teff, wheat and maize. Teff is grown by slightly over 60% of farmers and generates about 20% of farmer income. Wheat is grown by about half of the farmers, especially in the highlands, and generates about 16% of farmer income on average. Maize is cultivated by about 60% of farmers and generates about 12% of farmer income. The crop-mix varies significantly by location and altitude, but farmers within the same Woredas are likely to cultivate similar crops. On average, households cultivate three to four different types of crops. Despite crop diversity, reliance on cereals is high. An estimated 58% of farmer income is generated from cereals, including teff, wheat, maize, barley and sorghum.

- Agriculture is all about getting the timing right. Fine-tuning the insurance product in such a way that it has the flexibility to address the slightly different timing needs of different groups of farmers might increase its appeal.When rolling out micro-crop insurance it is important to keep in mind that:Separate approaches might be required in the east and west of Ethiopia. The eastern part of the country receives the "Belg", as well as the "Meher", and experiences two harvest per year. The West of the country typically only experiences one harvest in a year.
- The timing of harvest can differ by location, altitude and crop.
- Different crops face a different set of risks, with respect to drought and disease. Certain crops are more drought prone, others more prone to pests and diseases.

Building sufficient flexibility into the design of the crop insurance product so that it can adapt to the local agriculture cycle and the nature of the crops might be a key factor of success.

5.3. Input costs

Understanding the costs farmers face when purchasing inputs is relevant to the design of the crop insurance products. An estimated 92% of farmers in sampled Woredas purchase their inputs on the market. We find that the median household spends about ETB 2,250 on input costs per year for fertilizer, pesticide, herbicide, fungicide and seeds its two main cereal crops. The biggest cost driver is fertilizer, which accounts for slightly more than half of the spend.

In this study we tested willingness to pay for drought and hybrid insurance products at two different coverage levels: ETB 2,000 and ETB 4,000. Based on the input cost estimates we

obtained we found that a coverage of ETB 2,000 would cover the costs of about 38% , of the farmers, ETB 3,000 would cover 64% of the of farmers, while a coverage of ETB 4,000 would cover the costs of about 77% of farmers. The farmers with the least coverage would be wheat producers, since wheat production is associated with the highest input costs.

A number of important insights to keep in mind for the design of the crop micro-insurance include:

- Different crops have different input cost structures. For example, wheat farmers need higher coverage levels on average than sorghum or maize farmers.
- The ETB 4,000 coverage option provides a much more comprehensive coverage for farmers. It The ETB 2,000 option does not cover the needs of a majority of farmers, especially if the compensation is partial. There is an important trade-off to consider in the design of the micro-insurance product between its affordability for farmers and its ability to fully mitigate risk.
- Finally, it is also important to take into consideration the general equilibrium effects of crop micro-insurance on the prices of inputs. A large-scale roll-out of the crop micro-insurance product might impact the price of key inputs, including seeds, fertilizer, pesticides, herbicides and fungicides in the aftermath of a covered shock.

5.4. Willingness to pay for drought insurance

The WTP for the drought insurance product at a commercially viable rate is higher than anticipated:

- Approximately 50% of farmers are willing to pay the commercially viable rate (ETB 300 or 15%) for drought insurance with a coverage of ETB 2,000, with a margin of error of about +/- 12 percentage points.
- About 37% of farmers are willing to pay the commercially viable rate (ETB 600 or 15) for drought insurance with a coverage of ETB 4,000, with a margin of error of about +/-18 percentage points.

It is important to note that willingness to pay does not imply that farmers will actually purchase the product when it is launched commercially. We interpret these results to be more indicative of what farmers are able to pay to for crop insurance, rather than how likely they are to purchase crop insurance at a given price point.

We find that farmers are price sensitive for both drought insurance products (for a coverage of ETB 2,000 and ETB 4,000). The WTP decreases quickly with relatively small changes in price. Interestingly, one of the largest drops in willingness to pay levels occurs at the ETB 200-ETB 250 price, which is also the cost of CBHI health insurance. The large drop in willingness to pay we observe at that price point, might be explained by the fact that farmers are anchoring their response on the CBHI premium.

A very clear pattern is that farmers focus on affordability on the added benefits of the insurance product. We see this clearly with coverage. Farmers are only willing to pay a slightly higher premium for double the insurance coverage; this suggest that rather than considering the rate (premium over coverage) farmers consider the affordability of the premiums they are shown.

5.5. Willingness to pay for hybrid insurance

For hybrid insurance, WTP is low and there is no significant difference in WTP between the different premium rates. This is partly explained by the fact the hybrid insurance costs much more than drought insurance, hence is more unaffordable for most farmers.

We find that price-anchoring plays an important role in determining the WTP of farmers for hybrid insurance. All farmers in the sample were asked about their willingness to pay for both drought and hybrid insurance. Questions about hybrid insurance came after WTP questions about drought insurance. Since hybrid insurance is a qualitatively superior product for the same level of coverage, we ensured that the random price point that was asked of farmers for the hybrid insurance was always higher than the random price point asked for the drought insurance product. Evidence suggests that this has created strong anchoring effects.

The strength of the anchoring effect implies that we cannot interpret WTP results for hybrid **insurance to accurately reflect farmers' willingness to pay for the hybrid insurance product.** It also suggests that when presenting several insurance products to households in rural areas there is a real risk that households would go for the cheapest insurance option, not the best option for them in terms of the breadth and value of the coverage they receive.

5.6. Determinants of willingness to pay for crop insurance

Beyond rate and coverage, we find that socio-demographic factors may also be associated with WTP for insurance products.

Key determinants include:

- Income. Household income levels are the strongest predictor of willingness to pay for drought insurance. Evidence suggests that the effect of income becomes stronger for higher absolute premium rates. The higher the premium of the insurance product, the greater the barrier for low income households.
- Age. Age is also a strong predictor of willingness to pay. Younger respondents were more likely to be willing to purchase drought micro-insurance and were willing to pay more for it.
- Crop. The type of crop seems to matter: evidence points to lower willingness to pay for drought insurance levels amongst maize farmers. While we cannot exclude the fact that this correlation is spurious[10], maize is known to be a more drought resistent crop. This might lead farmers to be less willing to pay for crop insurance.
- Prior exposure to insurance. Farmers with health insurance are willing to pay more for drought insurance.
- Geographic variation in willingness to pay levels is high. While we do not have sufficient precision to report results by Woreda, econometric analysis reveals that there is high regional variation in willingness to pay levels by Woreda.

[10] In a spurious correlation, there is a third variable that is correlated to the two variables for which causality or correlation is established, i.e. there may be a third variable that explains the correlation between maize and TP.

Understanding the role of socio-demographic patterns is important for the better targeting of the micro-insurance products.

5.7. Farmer preferences for crop insurance

Finally, farmers were asked about some design preferences around drought insurance. A few key take-aways from these set of questions include:

- Hybrid vs drought. The majority of farmers (84%) prefer the hybrid insurance package to the drought insurance package. It is important to note that a preference for hybrid as a product does not imply that farmers would be more likely to purchase hybrid insurance over crop insurance, since farmers are very price conscious.
- Timing of payments. The majority of farmers (90%) would prefer payments to be made during or directly after the harvesting season.

Interest in loan from an MFI. An estimated 39% of farmers expressed interest in taking-up a loan from an MFI to pay for crop micro-insurance; it is important to note however that willingness to take-up a loan was significantly lower amongst farmers that were also willing to pay for crop insurance at the randomly selected price point.

These preferences should be taken into account in design of the insurance product.

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Annex A: Questionnaire

In order to answer the research questions of the present study, we develop a quantitative survey that is structured around several modules. The table below proposed shows the modules of the quantitative survey.

Module 1.	Survey Intro
Module 1.1.	Identification
Module 1.2.	Introduction and Consent
Module 1.3.	Verification
Module 1.4	Contact Information
Module 2.	Screening
Module 2.1.	Eligibility
Module 2.2.	Pre-screening
Module 3.	Demographic Characteristics
Module 3.1.	Basic demographics
Module 3.2.	Household financial information
Module 3.3	Poverty Probability Index
Module 3.4	Agricultural Activity
Module 4.	Financial and Insurance Knowledge
Module 4.1	Financial and insurance literacy
Module 4.2	Savings and shocks
Module 5.	WTP for Insurance Product
Module 5.1.	Intro to Product Design 1: Drought insurance
Module 5.1.1.	WTP Questions with pre-determined cover
Module 5.2.	Intro to Product Design 2: Hybrid insurance
Module 5.2.1	WTP Questions with pre-determined cover
Module 5.3	Preference for drought or hybrid insurance, Preference for timing of payment and Interest in loan and which institution.
Module 6.	Wrap-up

Module 1 is an auxiliary module that captures a set of meta-variables as well as the consent of the participant to answer the questions. While it has no direct research use, it is needed for data quality checks as well as obtaining the legal consent of the participant.

The purpose of Module 2 is to screen the respondents on their eligibility (Module 2.1). The respondent needs to own or manage cereal crops and need to be a smallholder farmer – cannot have more than 5 hectares planted with cereal crops – to pass the eligibility criteria. We then pre-screening farmers on their likelihood to buy an insurance product (Module 2.2). We use proxies the following for WTP: formal education; income higher than the second quintile; and exposure to more than two years of crop loss over the last five years. If the farmer does not meet any of these three requirements, we continue the survey with 50% probability.

In module 3, we ask basic household characteristics including age, education of the respondent and household size (Module 3.1). Followed by financial information from the household (Module 3.2), asset questions to be able to construct the Poverty Probability Index (Module 3.3) and questions about the household's agricultural activity (Module 3.4).

Module 4 focusses on knowledge and use of insurance and other financial products. The goal of this section is to understand their current understanding of insurance and other financial products. For farmers that don't have any insurance of financial product, we will probe why they have not felt the need to purchase an insurance.

Module 5 is the core module that will introduce the insurance products. Farmers are randomly appointed to a premium coverage of either ETB 2,000 or ETB 4,000. Farmers are then randomly shown a price for the drought insurance and asked if they are willing to pay the specified price for the product. If they accept the price, they are asked how much more they would be willing to pay. If they reject the price, they are asked how much they would be willing to pay (Module 5.2). This is repeated for the hybrid insurance (Module 5.2). Partners are still uncertain about a few parameters of the product design. Therefore, we ask which insurance farmers prefer, the timing of the payment, interest in getting a loan and the shocks they would want to be protected against (Module 5.3).

Module 6 is a standard closing module in survey. Its purpose is to thank the participant for their time and allow them to freely discuss any other issue they might want to talk about and that were not covered in previous modules of the survey.

Annex B: Overview of Sample

Region	Zone	Woreda	Primary Commodity	Secondary Commodity	Kebele
Amhara	South Gonder	Farta	Barley		Sahirna
					Teraroch
	South Wolo	Were Ilu	Wheat		Arefama
					Kiri Mariam
	West Gojjam	Gonji Kolela	Maize	Teff	Geregera Zuria
					Yinach
Oromia	Jimma	Botor Tolay	Maize		Chora Anchebi
					Saro Sinto
		Tiro Afeta	Maize	Teff	Qajelo
					Tiyyo
	Oromia Special Zone	Sebeta Hawas	Teff		Boro Hiro
					Nano Tefti
		Sululta	Barley		B/K/Mihirat
					Gimbichu
	West Arsi	Gedeb Asasa	Wheat and Barley		Ela
					Woka Cela
SNNPR	Gurage	Kebena	Teff		Shemola
					Woshareba Lagdima
	Siliti	Lanifaro	Wheat		Gebaba
					Repi
	Wolayta	Deguna Fanigo	Maize		Aruse Woyde
					Diguna Waraza Lasho
Tigray	Central	Tahtay Maichew	Teff		Adihutsa
					Dnbaza
	South Eastern	Seharti Samre	Wheat		Deqera
					Nebar Hadinet