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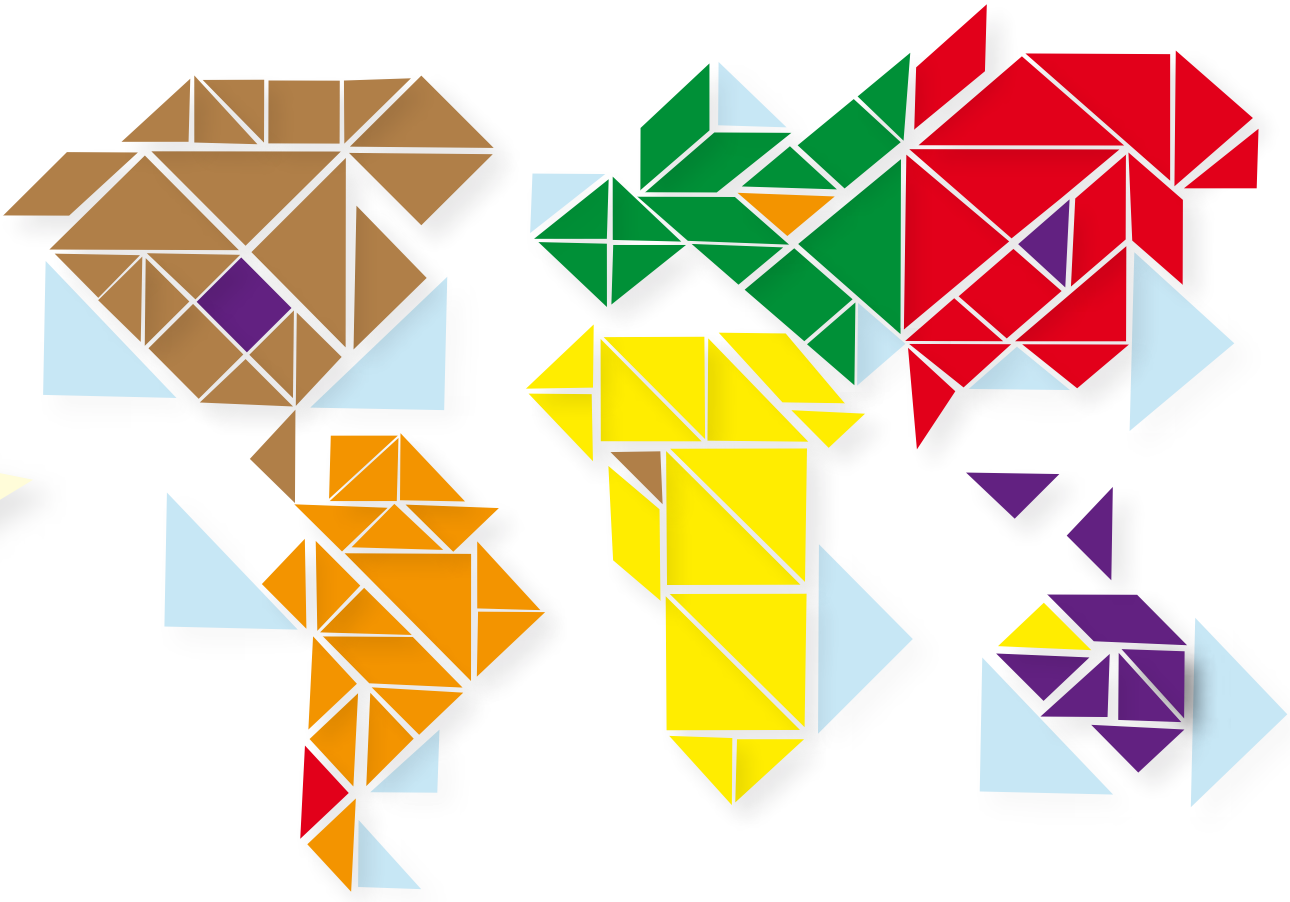
IMAGINING CULTURES OF COOPERATION:
UNIVERSITIES NETWORKING TO FACE THE NEW DEVELOPMENT CHALLENGES

Proceedings of the III Congress of the University Network for Development Cooperation (CUCS)

Turin, 19-21 September 2013



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UNIVERSITÀ DEGLI STUDI DI TORINO

Egidio Dansero, Francesca De Filippi, Emanuele Fantini, Irene Marocco (eds.)

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THE WILLINGNESS-TO-PAY FOR INSURANCE: EVIDENCE FROM SOUTHERN ETHIOPIA[1]

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ABSTRACT

Rainfall variability is a major problem in Ethiopia. The ability of Ethiopian farmers to deal with drought risk is made more scanty by the extension of land plots, which does not allow for a proper crop diversification, and by incomplete and inefficient financial markets which limit appropriate risk management financial strategies. Insurance can represent indeed a potential drought risk transfer mechanisms. However, the sustainability of a traditional drought insurance scheme is flawed by moral hazard, adverse selection, high administrative costs and risks not locally diversifiable. A promising alternative is index-based insurance whereby indemnities are related to an "index", rather than to verifiable losses. Several pilot projects and experiments have been carried out over the last fifteen years. This work is meant to contribute to such vast literature by reporting the results of an experiment carried out with Ethiopian farmers. Based on a sample of 120 rural households in the Wolayta zone - Southern Ethiopia, we aim to estimate the willingness-to-pay (WTP) for a drought index-based insurance product. Data were collected in 2013 through a discrete-choice experiment where household-heads were asked to make a choice out of different choice sets. Additional economic, financial and social data have been collected since 2011, within a wider research conducted on a larger sample including the one used in the current experiment. Data are analyzed employing a Mixed Logit model that allows for random preferences and overcomes a problem of the Multinomial Logit model, i.e. the irrelevance of independent alternatives (IIAs). The study is still in the implementation phase. Main preliminary outcomes are presented.

INTRODUCTION

The consequences of man-made or natural shocks in rural areas of poor countries can be devastating but even non catastrophic adverse conditions may challenge farmers. Traditional strategies followed to comply with this vulnerability, such as having some savings or diversify production, or informal insurance mechanisms may not be effective (Fafchamps, 1999) while the adoption of formal insurance has generally been considered as challenging both for farmers and for the insurers (Brown, 2001). Many examples of failures in crop insurance are reported in the literature; schemes based on estimated crop losses suffer of moral hazard which loosens farmers' commitment in production with an adverse selection effect where only bad farmers buy insurance (Hess, Richter and Stoppa, 2002). On the opposite, relatively new products base the compensation on the value taken by properly designed, standardized, verifiable climatic indexes (precipitation, wind-speed, temperature, solar radiation) with statistical correlation with crop yields which cannot be influenced by the customer behaviour (Bryla, Dana, Hess, Varangis, 2003). Prevailing contracts are area yield, livestock, weather indexes or weather derivatives (Hess, Richter, and Stoppa, 2002; Skees, 2003). Results of pilot projects based on these contracts are expected to reduce farmers revenue volatility (Hill and Robles, 2011). However, take-ups seem still meagre (Sarris, 2013; Clark and Kalani, 2011) and weak points are stressed. They are related to basis risk, to their cost[2] and to limited delivery channels. Elabed et al. (2013) and Hill et al. (2011) suggest index products with more than one risk included to reduce the impact of basis risk and to improve WTP, but the latter also depends on many other factors.

Several studies attempting to better understand WTP of rural farmers in poor countries mainly rely on experiments, given that the market still has to be developed (Breidert, Hahsler, and Reutterer, 2006, as quoted by Hill et al., 2011).

[1] This research, based on a field experiment, is conducted by the "Finance and Development – FinDev" group of the Research Center on International Co-operation of the University of Bergamo in co-operation with Wolayta Soddo University (WSU-Ethiopia), College of Business and Economics (CBE). The two universities co-financed in equal share the research. The study represents a complementary analysis to the main research project named MicroRiMI (Microfinance, Risk Management and Innovation) through which FinDev has been collecting data – with the co-operation of WSU- in the same area of Ethiopia since 2010. MiroRiMI is sponsored by the University of Bergamo, Giordano Dell'Amore Foundation (Milan), Cariplo Foundation and Lombardia Region. The current paper is a very preliminary version of the main outcomes of the experiment. The full paper will benefit of further development of the analyses and will be complemented by a second, refined, round of the experiment foreseen for November 2013. Davide Castellani contributed to this version with literature review, experiment design and data analysis and interpretation; Belaynesh Tamire worked on data collection and data entry and Laura Viganò worked on literature review and experiment design.

[2] For more details, see Skees (2003), Hess (2003) and Larson, Varangis and Anderson (2002).

While experiments have been considered useful for the learning process that they trigger in potential customers (Patt et al., 2009), their efficacy has been challenged in some studies when limited correlation was found between outcomes from experiments and choices of real insurance (McIntosh et al., 2013) although for other authors this is not the case (Norton et al., 2011 and 2012). Factors affecting WTP pertain to the customer characteristics or the type of actors involved. Patt et al. (2009) point out that most studies focus on economic explanations while behavioral factors (emotions and trust in the suppliers, in the product or in oneself) may matter more. Among factors quoted by many authors, the attitude toward risk may be mentioned. Correlation between risk aversion and WTP may have opposite signs, sometimes counter-intuitively; a negative correlation was found, under specific conditions, by Giné et al. (2008) or Hill et al. (2011). According to Sakurai and Reardon (1997), Gautam et al. (1994), the demand depends, among other things, on households risk management strategies. Wealth is also relevant. Patrick (1988) found higher level of net worth associated with lower premiums. Assets, in fact, may allow to better absorb income shocks; however, even the opposite may be true if ownership of larger amount of assets induces the farmer to take risky decisions and, therefore, to buy insurance (Akter et al., 2009 find positive relationship between land owned and insurance). An ambiguous behavior related to wealth is proved by Clarke and Kalani (2011) which find the highest take-up ratio with intermediate wealth levels; in fact, too poor farmers may have nothing to lose and do not need to insure, while very rich farmers may have other options than weather index insurance (Castellani et al., 2013). Cole et al. (2009), find that insurance demand is sensitive to cash on hand but this depends on the source of cash; for example, Sakurai and Reardon (1997) find negative significant effects of off-farm income and livestock holdings on demand for formal insurance as both allow to implement self-insurance mechanisms. Indirectly linked to cash holdings, Giné et al. (2008) find that credit constraints reduce the purchase of insurance, possibly because it limits cash availability. On the other side, being indebted could negatively affect WTP if all cash is used to repay the loan. Related to the characteristics of the farm, Hill and Robles (2011) found that that farmers with poorer soil quality buy more insurance and Sakurai and Reardon (1997), stress the dependence of demand for drought insurance on the agro-climatic zone. The nature and types of different disaster risks are also important factors for insurance participation decision. Related to farms profitability, absolute value of income influences WTP (Akter et al., 2009) but income variability is relevant as well (Fraser, 1992). A quite controversial effect may be expected by the presence of aid as, while it undoubtedly increases available cash, it distorts demand. Experiments are often based on an initial "artificial" cash endowment which may have important distortions on behaviors during the game (Sarris, 2013) and may even compromise the possibility to implement a real project at market conditions (not subsidized).

Besides individual, households, or area characteristics, also the type of channel or strategy to offer insurance may make the difference, both in terms of accessibility and in terms of knowledge and trust by the potential customer. The latter could be increased if the delivery happens through risk sharing groups (Cole et al., 2009) and if marketing visits are constantly offered[3]. Education may help increasing knowledge of products and, then, trust (Akter et al., 2009) although some studies do not find direct correlation between education and WTP (but this may depend on the type of education provided). Knowledge, in turn, depends on the complexity of the contract, defined by its conditions: price, maturity, delivery methods, index chosen, triggers or thresholds. Price is relevant for Cole et al. (2009) while, as mentioned, basis risk is outlined by many studies (Fuchs and Wolff, 2011; Hill and Robles, 2011).

The ones quoted are just some of the possible patterns in exploring WTP for crop or drought insurance in poor rural areas. The Ethiopian case has been heavily analyzed. Among the relevant studies, Hill and Viceiza (2010), conducted a field experiment on a sample 261 Ethiopians of Silte Woreda (Southern Ethiopia), exploring the link between fertilizers purchase and the offer of weather insurance. Insurance showed positive effects on the purchase of fertilizers. Clark and Kalani (2011) studied the rationality of actual purchases of insurance using data on 378 farmers from the Ethiopian Rural Household Survey (ERHS), and conclude that while behavioral explanations to the low take-up rate offered by other studies could be weak, farmers buy few contracts because of rational decisions, due to the type of product offered. Hill and Robles (2011), working with farmers of Silte Woreda on the idea that farmers are different in their production and preference structures, show the need to offer diversified insurance contracts. Hill et al. (2011)studied 1,400 Ethiopian households for 15 years as part of the Ethiopia Rural Household Survey; they explored many aspects of WTP related to the product and farmers' characteristics; for example, they found that insurance contracts are more likely bought by educated, wealthy and proactive potential customers. The role of local risk sharing groups as channels was outlined as well. Norton (et al., 2012) implemented a study based on experimental games in Tigray in 2010, within the HARITA[4] project to compare different choices among options on the use an initial endowment of 70 birr: taking the drought index insurance, investing in simulated savings accounts, participating into risk-sharing groups, or holding cash. Preference for higher frequencies of payouts was recorded together with more frequent choice of insurance over savings and over participation in risk sharing groups and, in some cases, over cash holdings. McIntosh et al. (2013) focused on fertilizers and their relationship with weather index insurance in Amhara region. They considered many factors among which credit and insurance availability and worked on two different research approaches: a survey estimating WTP and the observation of actual purchases. Although not completely comparable, also due to some weaknesses in the offer of the real product, slightly positive or even negative correlation is found between the two approaches. Purchases in the study sample were lower than those of the total population. Behavioral variables or basis

[3] As stated, Patt et al. (2009) consider experiments as possible ways to increase trust.
[4] Horn of Africa Risk Transfer for Adaptation.

risk (probably not well known) were little influential. Lack of cash was an obstacle to take-ups which were mainly driven by in cash endowments (vouchers offered by the researchers).

Besides the numerous weather insurance pilots projects, in Ethiopia, practical implementations are increasing. Among them, the Ethiopian Project on Interlinking Insurance with Credit in Agriculture (EPIICA) offered by Nyala Insurance Company (NISCO) and Dashen Bank in Amhara region (quoted by McIntosh, 2013). Nahu (2010) describes several products, including a weather derivative through which the Word Food Program made the Government of Ethiopia buy a coverage by AXA Re in 2006 in order to obtain eventual financial resources for food aid in case of extended drought, and the one offered by the Ethiopian Insurance Corporation (EIC) in co-operation with the World Bank in 2008. The other products described are offered by NISCO: a pilot Double Trigger Multiple Peril Crop Insurance (DTMPCI) and a Weather Index Crop Insurance. The first was an area yield insurance started in 2007 in Oromia State; the second was first offered in 2009 in collaboration with OXFAM America and World Food Program in Tigray and Oromia regions, then extended in the South and in Amhara Region. Overall, the author lists some weakness and strengths of these pilots. Among the first, lack of awareness by famers, of a suitable regulatory framework, and, very important, lack of reliable data. Also delivery channels are limited as insurance companies are based in towns and this increase transaction costs. However, the author stressed the increasing attention of the government to small farmers, the expected establishment of a reinsurance intermediary in Ethiopia, and the abundance of research and technical assistance. The author concludes with a positive judgment on these experiences by stressing the need of collaboration among the different actors and, at the farmers' level, the importance to also consider other risks faced by farmers. This latter statement also emerged in Volpi (2005) who, being involved in the first phases of the implementation of the pilot project by the EIC and the World Bank in 2008 mentioned by Nahu (2010), stressed the reasons why farmers were not so reactive to the proposed insurance contract. In fact, after the instruction phase, only 26 farmers bought the contract. Volpi (2005) stressed the rationality of farmers who stated that the contract was only addressing one important risk but several other risks equally important were affecting their vulnerability. Therefore, they could not afford to pay for only one of them.

The next section describes the experiment conducted in this study and reports the preliminary results.

EXPERIMENT AND AMMINISTRATION OF THE SURVEY

In the study, we take a full client's perspective instead of a supply's perspective. The objective of is to have an understanding of who is the potential client and of the willingness-to-pay for drought insurance. No formal crop insurance was indeed available in the area where the survey was conducted. The hypothetical product was not designed according to the real rainfall data and tuned on the base of farmers' feedback, but we adjusted a product that was already available in another area of the same region[5]. The product is a weather derivative that pays a fixed indemnity when either a moderate or severe shortage of rainfall occurs in a specific month of the agricultural season (Hill and Robles, 2011). Farmers can get as much securities as they are willing to buy. This pilot-project was employed as a benchmark in order to build reasonable hypothetical products that farmers can afford. The actuarially fair price is thus unobserved but we can expect that it lays in one or more of the different premium-indemnity combinations that we consider in the discrete choice experiment.

In the preliminary phase of the experiment, we carried out focus-group interviews in the villages in order to understand farmers' perception about drought risk and to outline a shared definition of moderate drought and severe drought, respectively.

The categories of the product attributes are five: covered season, intensity of drought, supplier, premium and indemnity. In particular, the covered season category has two levels: *Belg* season, i.e. the small rainy season between the beginning of March and the end of May, and *Meher* season, i.e. the big rainy season between the beginning June and the end of September. The insurance supplier category has four levels: microfinance institution (MFI), farmers' cooperative, informal insurance association (*Iddir* in local name), and *Kebele* (the smallest administrative unit of Ethiopia).

The survey was administered by a team of ten trained enumerators to 120 farmers over a period of three weeks, in March 2013. The farmers were randomly selected from a larger sample of 360 farmers already involved in a three-year data collection project (2010-2013). The surveyed farmers are from three *Kebele*, of the Wolayta area located in the SNNPs Region of Ethiopia[6].

The three villages are Hembecchio, Kutto Sorfella and Abala Faracho. Each village is representative of one of three agro-ecological zones. The zones are named by the Ethiopian Ministry of Agriculture after the characteristic crops: ginger and coffee zone, barley and wheat zone, and maize and root crop zone.

EMPIRICAL METHODOLOGY

In this section, we analyze the household's optimizing behavior regarding the choice among different insurance alternatives. A household n faces a choice among J alternatives in each of T choice situations. We suppose that the

[5] See Hill and Robles (2011) for a comprehensive discussion of the product.

[6] For the sake of brevity, in the remainder of the paper we improperly refer to the *kebele* as villages.

utility that the household obtains from choosing alternative *j* is a linear combination of the insurance product attributes, x_{njt}, and a random term, ε_{njt}[7]:

$$U_{njt} = \beta_n' x_{njt} + \varepsilon_{njt} \quad (1)$$

Whereas the attributes are observed by the analyst, coefficient vector β_n is unobserved for each *n* and varies across households with density $f(\beta_n|\Omega)$ where Ω are the parameters of this distribution that are to be estimated. The stochastic element, ε_{njt}, is also unobserved and different assumptions on its distribution result in different choice models. As usually common in the choice analysis, we impose the condition that ε_{njt} is independent and identically distributed (IID) extreme value type 1 (or Gumbel) across all *n*, *j* and *t* (Hensher, Rose and Greene, 2005). Conditional on β_n, the Logit probability of household *n* choosing alternative *j* in the choice situation *t* is:

$$\pi_{njt}^{std} = \frac{e^{\beta_n' x_{njt}}}{\sum_i e^{\beta_n' x_{nit}}}, i = 1, \ldots, J \quad (2)$$

The standard Logit model, as expressed by (2), does not allow for unobserved characteristics that can induce correlation among alternatives in a choice situation and among choices over time. The Mixed Logit model, i.e. the unconditional logit probability, overcomes these restrictions by allowing for the variance in the unobserved household-specific parameters and, therefore, does not exhibit the property of Independence from Irrelevant Alternatives (IIA) (Revelt and Train, 1998). The Mixed Logit probability is:

$$\pi_{njt}^{mix} = \int \left(\frac{e^{\beta_n' x_{njt}}}{\sum_i e^{\beta_n' x_{nit}}} \right) f(\beta_n|\Omega), i = 1, \ldots, J \quad (2)$$

The (2) is a weighted average of the logit formula evaluated at different values of β_n. It follows that the Mixed Logit probability for the sequence of choices is:

$$\Pi_{njt}^{mix} = \int \prod_t \left(\frac{e^{\beta_n' x_{njt}}}{\sum_i e^{\beta_n' x_{nit}}} \right) f(\beta_n|\Omega), i = 1, \ldots, J \quad (3)$$

In (3), we want to estimate Ω, that is, the population parameters that describe the distribution of individual parameters (Revelt and Train, 1998).

HOUSEHOLDS' CHARACTERISTICS

We include several variables that proxy for household's characteristics in order to allow for potential heterogeneity in the attributes' coefficient. An important household's characteristic is net income. It is, along with the price, the usual component of demand models. However, we are unable to properly estimate net income. The expenses borne by the household over the period when the income is generated are to be deducted but the current data available do not allow for a proper costing[8]. For that reason, the net income is not included in the analysis.

As alternative proxy of the household's economic capacity we use the household's net-worth, that is, the difference between total assets and total financial liabilities. Total assets include agricultural assets, non-agricultural assets, and financial assets[9]. Financial liabilities are made up of all outstanding debts. The net-worth is also a proxy for the ability of the household to cope with negative shocks and make up for unexpected expenses. However, we do not control for the different liquidity costs of assets. Instead of considering the absolute value of net-worth, we test for a non-linear relationship with the insurance take-up probability by taking net-worth percentiles.

The land holding is not considered in the assets since in Ethiopia it is not an household's property, cannot be transferred or used as collateral[10]. Farmers are used to establish crop-sharing or short-term rent agreements. The size of land is however important in the decision of what to crop and to what extension. Besides, when the land does not provide for a living, farmers are forced to seek for alternative source of income. We control for the households' land

[7] The expression (1) is how the utility is usually represented in discrete choice models (Hensher, Rose and Greene, 2005).
[8] This is one of the objectives of the three-year research project that is expected to end in December 2013.
[9] The non-agricultural assets are: bicycles, motorcycles, radio sets, mobile phones, jewels and watches, tables and chairs, and beds. The financial assets are savings and outstanding credits.
[10] In Ethiopia the land is owned by the government.

holdings in terms of *timad*, that is, a local unit of land[11].
Other characteristics may proxy for the interviewee's risk aversion such as the interviewee's age, gender, and the number of family members. Others, such as the education, can influence the ability to understand the insurance product and properly appreciate the insurance's utility. We consider if the interviewee is both literate and the grade reached.

Since trust and transaction costs are significant determinants of financial contracts, we expect that being client of a microfinance institution, member of a local cooperative, or part of one o more *Iddirs*, i.e. local informal insurance parties, can increase the respective likelihood to prefer one supplier instead of another one.

Finally, we include some dummy variables to control for basis risk. In our case, the basis risk is the probability of receiving an indemnity when the households are not affected by drought, or not receiving an indemnity when it is affected. The dummy variables are built on stated perceptions of how different is the rainfall pattern at the household's field compared to where the weather station is located, and how much more or much less it rains at the weather station than at the household's field.

Table 1 reports all attribute and control variables.

Tab. 1 – Variables.

Variable name	Definition	Unit	Type
Product's attributes			
Premium	Cost of the insurance contract	ETB	Integer
Indeminity	Expected payment in case of drought	ETB	Integer
Belg	If Belg is the covered season	0,1	Dummy
Perceived probabilty	How often a moderate or severe drought occurs	Years	Integer
Cooperative	If cooperative is the suppplier	0,1	Dummy
MFI	If MFI is the supplier	0,1	Dummy
Iddir	If Iddir is the supplier	0,1	Dummy
Households's and interviewees's characteristics			
Networth lower than 2nd centile	Networth <= ETB 4,055	0,1	Dummy
Networth between 2nd and 4th centiles	ETB 4, 055 < Networth <= ETB 6,902	0,1	Dummy
Networth between 4th and 6th centiles	ETB 6,902 < Networth <= ETB 11,155	0,1	Dummy
Networth between 6th and 8th centiles	ETB 11,155 < Networth <= ETB 14,780	0,1	Dummy
Networth greater than 8th centile	Networth > ETB 14,780	0,1	Dummy
Log of landholdings	Household's landholdings	Log(Timad)	Continuos
Age	Interviewee's age	Years	
Gender	If the inteviewee is male	0,1	Dummy
Number of fam. members	Number of members who live with the head	N.	Integer
Illiterate	If the interviwee is illiterate	0,1	Dummy
Education	Grade reached at school	N.	Integer
Cooperative client	If client of at least one cooperative	0,1	Dummy
MFI client	If client of at least one MFI	0,1	Dummy
Iddir member	Number of Iddirs where the HH is member	N.	Integer
Very different pattern and less rain	Very different rainfall pattern and less rain on average	0,1	Dummy
Somewhat different pattern and less rain	Somewhat different rainfall pattern and less rain on average	0,1	Dummy
Somewhat different pattern and more rain	Very different rainfall pattern and less rain on average	0,1	Dummy
Very different pattern and more rain	Very different rainfall pattern and more rain on average	0,1	Dummy

ESTIMATES OF MARGINAL EFFECTS AND WILLINGNESS-TO-PAY

A preliminary analysis was carried out considering all the variables listed in Table 1. However, in the final model we retained only those variables that turned out to be statistically significant and sufficiently consistent over different model specifications. Table 2 presents the estimation results of the Conditional Logit (CL) model and the Mixed Logit (ML) model. The estimates coefficients of the ML are almost all significant and the overall goodness of fit is somewhat higher than in the CL. Besides, the standard deviations of the two random coefficients are statistically very significant and important in terms of size. This suggests that the ML is more appropriate.

The premium coefficient is negative as expected and the marginal effect implies that, for instance, an ETB 100 increase in the insurance price decreases the likelihood to purchase it by 28%. The price's marginal effect accounts for the opposite behavior, that is a positive coefficient, of high net-worth households who, given the average experiment

[11] Four *timad* are approximately one hectare.

premium, are more willing to purchase insurance by 13%, on average. Unexpectedly, the indemnity coefficient is also negative and reflects unobservable motivations. Given that premium and indemnity are almost uncorrelated by experiment design, one reasonable explanation is that the greater the indemnity the lower the trust in that the indemnity will be actually paid. However, further analysis is required.

Despite the majority of interviewees stated to deem *Meher* as the most important agricultural season, the results hint that they prefer to insure against a possible drought in the *Belg* season. The likelihood to choose an insurance product that covers the production in the *Belg* season production is greater, on average, by about 6%. There are, though, some differences among households in terms of preferred season. In particular, households that have got a net-worth between the 2nd and 4th centiles and households that believe that the rainfall pattern on their field is somewhat different from that at the weather station and it rains more on average, tend to prefer the *Meher* season. On the other hand, households that believe that the rainfall pattern on their field is very different from that at the weather station and it rains less on average, tend to prefer the *Belg* season. These results put forward that *Belg* season is believed to be more exposed to drought risk.

Tab. 2 – Estimation results.

	Conditionla Logit		Mixed Logit		
Variable	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Marg. Eff.**
Premium	-0.0242***	0.0027	-0.0229***	0.0032	-0.0028
Premium * Networth greater than 8th centile	0.0108**	0.0043	0.0126***	0.0049	0.1273
Indemnity	-0.0183***	0.0019	-0.0089***	0.0033	-0.0012
Belg season	0.4257*	0.2522	0.8322***	0.3015	0.0578
Belg season * Networth between 2nd and 4th centiles	-0.9615**	0.4254	-1.4150***	0.5159	-0.1056
Belg season * Very different pattern and less rain	0.6398	0.4044	0.7637*	0.4338	0.0570
Belg season * Somewhat different pattern and more rain	-0.9973***	0.2834	-1.1430***	0.3123	-0.0853
Perceived probability	0.0120	0.0176	-0.3092***	0.0916	-0.0427
Std. Dev. Perceived probability			0.2647***	0.0626	
Cooperative	-0.8737***	0.2501	-0.8162**	0.3206	-0.0337
Std. Dev. Cooperative			0.8608***	0.2985	
Cooperative * Illiterate	0.7645**	0.3299	0.9399**	0.4117	0.0367
Cooperative * MFI client	1.1080***	0.3299	1.3776***	0.4413	0.0538
MFI	-0.1021	0.3615	0.5569	0.4645	Not sig.
MFI * Networth between 2nd and 4th centiles	-1.8004***	0.5081	-2.6278***	0.6825	-0.0916
MFI * Illiterate	1.2242***	0.3698	1.6568***	0.4592	0.0577
Iddir	-0.3271	0.2875	0.1556	0.3675	Not sig.
Iddir * Networth between 2nd and 4th centiles	-1.585***	0.5181	-2.2017***	0.6311	-0.0758
Iddir * Illiterate	0.6566*	0.3365	0.7934**	0.3863	0.0273
Number of ob.s	1872		1872		
LR - $\chi 2$	421.74***		58***		
Pseudo-R2	0.325		0.371		

*** Significance level at 1%
** Significance level at 5%
* Significance level at 10%

The perceived probability, i.e. how often a moderate or severe drought event occurs, lowers the likelihood to purchase drought insurance. This means that there is preference for insurance against moderate drought since it recurs more frequently and may be forecast with less uncertainty than a severe drought. Furthermore, poor rural households are probably impatient and discount long-term realizations more than the better-off. For instance, an increase of 3 years in the perceived probability of drought decreases the likelihood to purchase insurance by nearly 13% on average. The standard deviation of the perceived probability is also statistically significant but small, and implies that for 12% of the population the coefficient is positive instead.

With regards to the preferred insurance supplier, the results are somewhat uncertain. The only statistically significant coefficient is for the cooperative variable. If the insurance products were distributed by the cooperative instead of the administrative unit, i.e. *Kebele*, the willingness to purchase would decrease by 3% on average. The standard deviation is also very significant both statistically and in economic size. For 39% of the population the coefficient is indeed positive. The cooperative as insurance supplier is mostly preferred by illiterate interviewees and MFI clients. On the contrary, the coefficients for the MFI and *Iddir* variables are both positive but not statistically significant. However, as well as for the cooperative case, illiterate interviewees have a preference for both the MFI and the *Iddir* instead of the *Kebele*. MFI and *Iddir* are, on the contrary, less preferred by households with a net-worth between the 2nd and 4th centiles.

Table 3 presents the average estimates of the willingness-to-pay for the insurance attributes computing as the negative ratio of the attribute' coefficient and premium's coefficient. First, households would pay a lower premium by ETB 0.46 for every increase in the indemnity by ETB 1. Second, households would pay about extra ETB 11 for an insurance product that covers the *Belg* season. Third, for every more year in the perceived drought probability, households would pay a lower premium by nearly ETB 15 on average, but this is true for the 88% of the sample. The remaining 12% of the sample would pay more for an insurance product against a long-term severe drought. Finally, households would pay about ETB 13 less on average if the supplier was a local cooperative instead of the *Kebele*, but the 39% of the surveyed households would pay a higher premium.

Tab. 3 – Willingness-to-pay estimates.

Average Willingness-to-Pay (in ETB)			
Attribute	**Mean**	**SD**	**WTP < 0**
Indemnity	-0.46	-	-
Belg	11.16	-	-
Perceived probability	-15.40	13.23	88%
Cooperative	-12.58	43.06	61%
MFI[a]	28.13	-	-
Iddir[a]	-1.81	-	-

[a]Coefficients are not significant

STANDARDIZED VS. CUSTOM-MADE INSURANCE PRODUCTS

Figure 1 and Figure 2 report the distributions of perceived probability of moderate and severe drought respectively. The stated frequency of occurrence of a moderate drought is very similar in the three villages considered, with an overall mean of 2.4 years and a standard deviation of 1.03 years. Besides, except for Kutto village, the shape of the distributions is also akin. Some differences can be observed in the frequency of severe drought but these are almost trivial in relative terms. For the severe drought case, the overall mean is 15.4 years and the standard deviation is 7.57 years. The differences are more remarkable when we look at the shape of the distributions with a median value between 10 and 20 years.

This preliminary analysis of the perceived probability provides some support to the design of a sole insurance product against the risk of moderate drought and, with appropriate caution, also against the risk of severe drought. In the development stage, the perceived probability must be however compared with the actual drought rainfall distribution in order to design a suitable product.

We here employ the ML model estimates of Table 2 to assess the convenience and attractiveness of hypothetical drought insurance products. In particular, we compare an *ad-hoc* product tailored according to the interviewee's perceived drought probability and different products designed according to a reference probability. This exercise allows to estimate the likelihood to purchase a standardized product (S) against a custom-made product (CM). We take different values as reference probability of drought that correspond to the ALL distribution's mean, mean plus one standard deviation, mean minus one standard deviation, mode, and median.

For every reference probability *k* and indemnity amount *j*, we, first, work out the equivalent fair premium (see Table 4) and, second, the market share (ΔMS) of CM as difference in terms of predicted aggregate likelihood of purchase. The latter is calculated as follows:

$$\Delta MS(kj) = \frac{1}{N}\sum_{i=1}^{N} P(CM|k, j, X),$$

where X are household's characteristics that interact with *k* and *j*. Since the other product's attributes are the same for both products, they are irrelevant in the decision process.

We find that, first, as the reference probability is increased, the premium shrinks and the market share of the standardized product grows. Second, when the reference probability is smaller than the average perceived probability, as the indemnity increases, the market share of the standardized product falls. On the contrary, when the reference probability is greater than the average perceived probability, the market share of the standardized product increases along with the indemnity. Finally, as the average perceived probability of drought heightens, such as in the severe drought case, the market share of the standardized product becomes less sensitive to changes in the reference probability and the amount of indemnity. It follows that, in the design of an insurance product for moderate drought, a small change in the reference probability and, then, in the fair premium, can lead to a big change in the willingness to purchase insurance. On the contrary, in the design of an insurance product for severe drought, small changes in the reference probability barely affect the willingness to purchase such product.

Fig. 1 - Kernel distribution of perceived probability of moderate drought (in years).

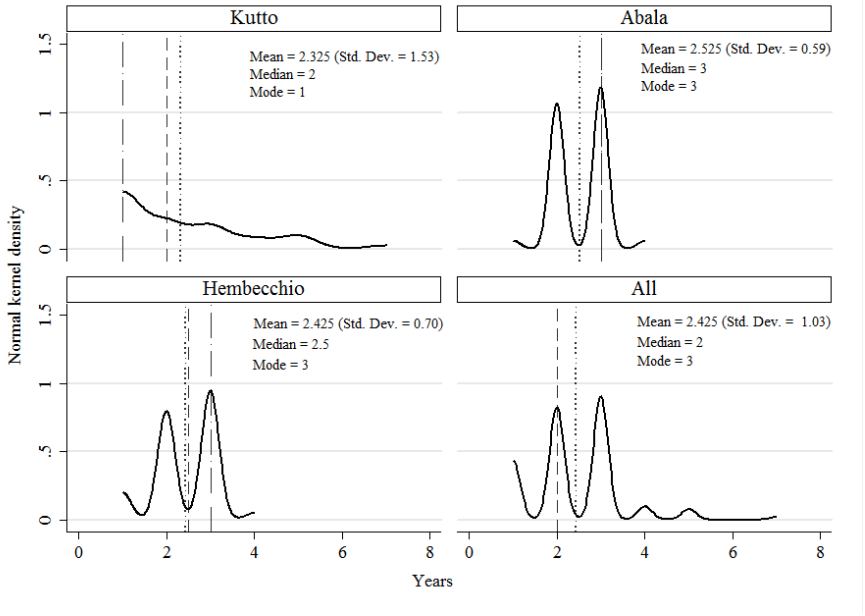
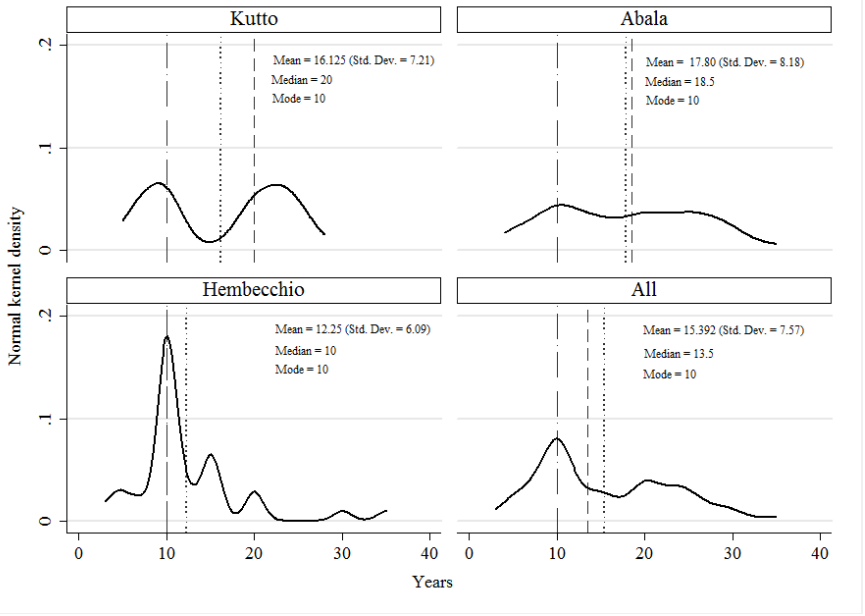


Fig. 2 - Kernel distribution of perceived probability of severe drought (in years).



Tab. 3 – Reference probabilities, indemnities and fair premiums.

Ref. prob. / Ind.	400	450	550	600
Moderate:				
1.395	286.74	322.58	394.27	430.11
2	200	225	275	300
2.425	164.95	185.57	226.80	247.42
3	133.33	150	183.33	200
3.455	115.77	130.25	159.19	173.66
Severe:				
7.80	51.28	57.69	70.51	76.92
10	40	45	55	60
13.5	29.63	33.33	40.74	44.44
15.39	25.99	29.24	35.74	38.99
22.99	17.40	19.57	23.92	26.10

Fig. 4 – Market share (predicted likelihood) of custom-made insurance product against the risk of moderate drought.

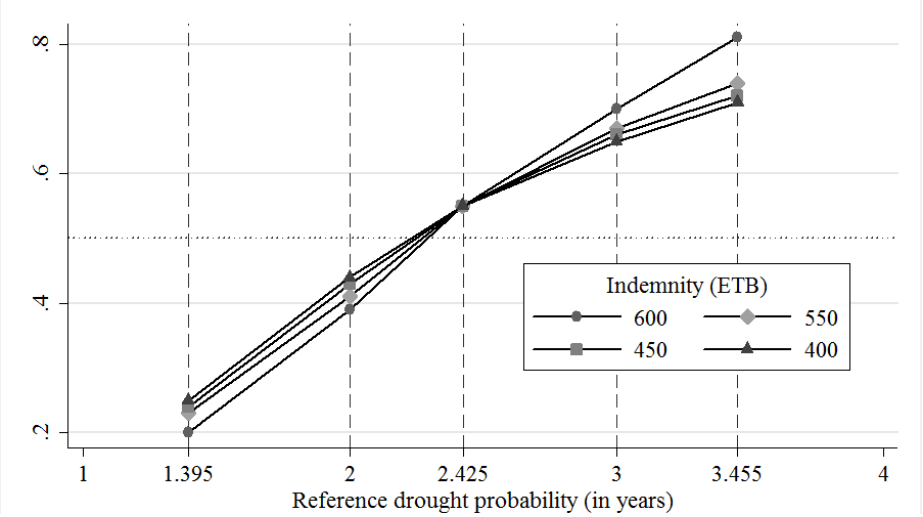
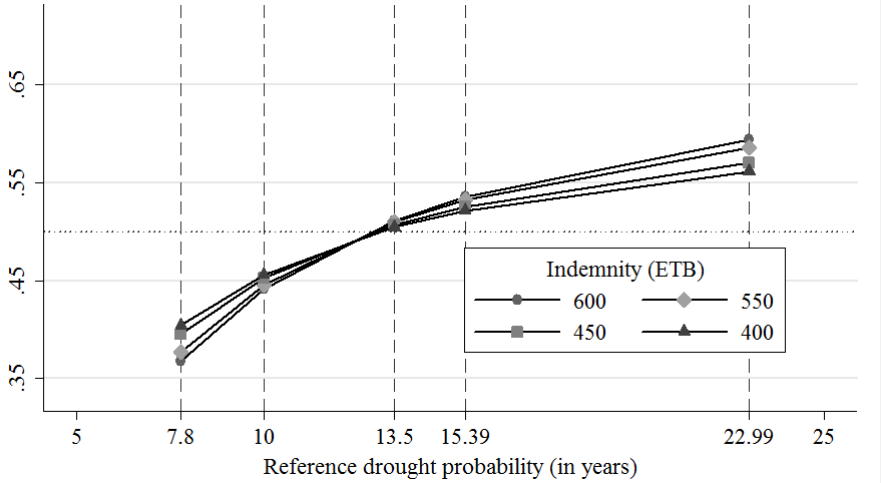


Fig. 5 – Market share (predicted likelihood) of custom-made insurance product against the risk of severe drought.



CONCLUSIONS

Crop insurance against the risk of drought is still in a pilot phase in Ethiopia and, especially in rural areas, the most of households are unaware of formal insurance in general. We carry out a stated choice experiment in three villages in Southern Ethiopia in order to assess the willingness-to-pay for an insurance product that pays a fixed indemnity if a drought occurs. We find that premium, indemnity and perceived drought probability are important determinant in the insurance take-up. The estimated coefficients of the three variables are all negative. Whereas a negative coefficient is expected for premium and perceived probability, it is counterintuitive for the indemnity and further investigation with alternative hypotheses testing is necessary. A market simulation analysis suggests that households are more sensitive to premium and indemnity changes when the insurance product is against moderate but more frequent drought events.

This study suffers, in particular, from a proper design of the insurance product. Further research should allow for different payment alternatives and let household buy more than one contract. A second round of the experiment is planned for November 2013 to address these points.

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