Investigating Demand for Weather Index Insurance: Experimental Evidence from Ethiopia

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1. Abstract

There is much interest in weather index insurance as a poverty-mitigating tool, but concerns persist about potential demand for the product among the poorest of the poor. This paper relates the experiences in rural areas of Tigray region, Ethiopia through both commercial sign-up data and a series of experimental games conducted to test demand for weather index insurance. Demand was observed to be considerable in both.

2. Introduction

Weather index insurance is a promising tool for managing weather risk among rural populations in developing countries that might otherwise be completely exposed to climate risks. By offering an easily transactable index, farmers are able to enter a formal risk pooling system, which helps them in times of stress and can provide the confidence necessary to take productive risks. However, despite the many potential benefits that accrue due to protection from weather risk, demand for the product until this point has been described as "disappointingly low." (Giné 2011) Several key insights have been contributed to the literature in recent years, but a complete picture of demand for index insurance is still incomplete and often controversial.

If index insurance is to reach its potential as a poverty-fighting implement, then demand for the product needs to be more precisely quantified and understood. In particular, take-up rates of index insurance products are judged to be inadequate and indicative of farmers' ability to self-insure against weather shocks more effectively than index insurance can offer. It remains to be seen if farmers in developing countries derive genuine usefulness from the income smoothing properties of index insurance, or if demand for index insurance is subsumed by deficiencies in its model, such as basis risk, or the additional costs of insuring risk with an outside organization.

Index insurance has seen a surge of interest in recent years, with more than 36 pilot projects in countries around the world (Hazell et al 2010). Measuring demand is complex in such diverse conditions, where potential customers are often outside the cash economy, do not have access to liquid assets, have difficulty obtaining credit, and may have little experience with transacting financial products. Since index insurance is such a new product, the answer to this question about demand depends not only on traditional economic literature, but also such topics as the rate of technological diffusion.

This paper describes the experiences of one such project, the HARITA project in Tigray region, Ethiopia, led by Oxfam America, Nyala Insurance, and Swiss Re (Chen et al 2010, Hellmuth et al 2009). During the 2010 cropping season, a series of experimental games were conducted in four villages, which found demand for index insurance to be quite high even when offered in conjunction with other risk

management options. By offering a choice between several risk management options, we study the risk preferences of participants relative to those other options. As we will explain, participants showed a strong preference for more expensive, frequent payout of a 1-in-3 year contract instead of a 1-in-5 year contract. Overall, we observe high demand for index insurance products, demand which outweighs other risk management options such as community-based risk pooling. At times, this demand even outweighs the option for receiving an immediate cash payment.

The strong demand for index insurance is supported by sign-up data from commercial sales of the insurance product. This insurance was offered partially through the provision of a cash-for-work program. Although it was a new product in four of the five total villages, take-up rates are estimated to be as high as 36%, with the same preference for more frequent payouts that appears in the experimental games.

These results have broad implications for the application of index insurance products and imply that demand for index insurance can be considerable even amongst the poorest of the poor if barriers to participation are removed.

3. Background

Weather index insurance is a relatively recent innovation that is seen as a way to smooth risk for farmers in developing countries (Turvey 2001, Skees 2008, Vedenov and Barnett 2004). By using an "index" of weather observations, such as rainfall, as a proxy for crop loss, the problems of traditional indemnity insurance are reduced or eliminated. Index insurance offers the promise of microinsurance to rural farmers in developing countries. This can serve a valuable function in a development intervention and may lead to more interactive benefits, such as improved access to rural credit.

However, based on a series of influential academic papers (Giné et al. 2008, Cole et al 2010, Giné and Yang 2009), the common wisdom among many academics is that weather index insurance suffers from low demand among smallholder farmers.

Giné and Yang (2009) conducted a randomized field experiment in Malawi in which farmers were offered credit by itself and also coupled with index insurance. They observed that take-up for the loan with index insurance was lower than the loan offered by itself, and suggest that this reveals that farmers can more efficiently self-insure above and beyond the ability of the insurance to smooth risk. However, it should be noted that take-up rates for both might be considered high (18% and 33%)

More empirical evidence on the patterns of rainfall insurance participation is presented by Gine, Townsend, and Vickery (2008), who offer results from a

household survey in India. They note that households with less land and less wealth are less likely to participate in index insurance projects, but that the two major constraints to index insurance participation are credit constraints and issues of familiarity or trust.

Cole et al (2009) conduct a series of controlled, randomized trials in India that account for several aspects of the index insurance business process. They identify three possible explanations for depressed demand for index insurance, which are high price-elasticity, liquidity constraints, and trust issues. In conclusion, the authors write:

"We do not view these barriers to index insurance as insurmountable, nor do we view the relatively low purchase rates as reflecting a lack of demand for pooling risk."

However, this seems not to be the message that has percolated to the wider academic community, where index insurance is seen as suffering from low demand and interest from smallholder farmers. This sentiment is well represented in a recent journal article by a noted luminary in the field, Hans Binswanger-Mkhize. In an article entitled "Is there too much hype about index insurance?" Binswanger-Mkhize (2011) states:

"Pilot index-based insurance programs for agriculture often find that demand for the offered products is low in three ways: (1) Only a small proportion of farmers buy the insurance offered; (2) the purchasers usually buy the smallest coverage offered; (3) the poor farmers who would benefit the most are not usually among the purchasers."

There is a rich history of experimental approaches for estimating risk appetites of people in developing countries. This paper also follows in the mould of several recent papers that use experimental activities to evaluate perceptions of risk (Lybbert et al 2009, Meze-Hausken 2004, Vargas-Hill 2009, Yusuf and Bluffstone 2009, Hill 2010) as well as in canonical literature (Binswanger 1980).

Index insurance can help manage covariate or yield risks, while idiosyncratic risks require a more individualized approach (Ligon 2009). One important idea explored through these games was the idea of a "community risk pool," where local organizations could provide remuneration for losses that occurred because of factors other than drought (Dercon et al 2006, Bhattamishra and Barrett 2009). Efforts need to be made as to how to work with these organizations to manage risks that are outside the capabilities of risk transfer mechanisms like weather index insurance. Future years of the HARITA project may see a portion of the premiums paid by the farmers given directly to community organizations, and exploration of this idea is of paramount importance for the project as it scales.

4. Experimental design

This game is designed to test demand for index insurance in the presence of several other risk management options. Participants were given a small endowment (about 5 USD, or 70 birr) and asked to distribute it among those options. The amounts assigned to each category were in multiples of 5 birr, for a total of 14 "units" to allot to the various options. All options were offered simultaneously except for the choice among types of index insurance, which were offered exclusively of each other.

The experimental games were conducted with approximately 100 participants at each of four villages in Tigray Region, namely Adi Ha, Awet Bikalsi, Geneti, Hade Alga. The first two of these villages, Adi Ha and Awet Bikalsi, are adjacent to each other in the *woreda* of Kola Tembien in central Tigray. The last two Geneti and Hade Alga, are approximately 10 kilometers apart in the *woreda* of Raya Azebo. Summary statistics of the participants are listed in Table 1.

The index insurance contracts in this game were calculated according to the heuristics of the HARITA project and were almost identical to the actual commercial products that were being offered. This necessitated two visits by the research team; one to allow participants to make their initial allocations, and one to resolve any payments that resulted from those allocations. The first visit to Tigray was from April-May 2010, before the growing season, and the follow-up visit was conducted in November 2010.

There were a few distinctions between villages: the insurance sales were offered in Adi Ha in the previous year, but not any of the other three villages. (However, given the proximity of Awet Bikalsi to Adi Ha, the participants in the former were almost certainly aware of the project.) In addition, the agronomy of the two villages is slightly different, in that the planting had already started in the Raya Azebo region (Geneti and Hade Alga), but had not yet begun in Kola Tembien (Adi Ha and Awet Bikalsi). See Table 2 for a short description of the differences between the two areas.

[Table 2 about here.]

The four options for how to distribute that endowment were:

1) Keep the money

The option to *keep the money* consisted of the portion for which the participant wanted to receive that day. This was offered in lieu of a participation fee, and was the only option in which people could receive any payment on the initial visit.

2) A "savings" account

The *"savings" option* was intended to simulate an interest-bearing account. The money committed to that option was disbursed in November with an additional 10% bonus (equal to a 20% annual rate). This percentage was chosen for ease of

computation and payment of currency, and is far more generous than the 6% annual rate that banks offer for savings accounts.

3) A community risk pool (or group savings account)

The *community risk pool* option in the game builds on farmers' associations that are already present in the communities (called *iddirs*). The money committed to the community risk pool was likewise disbursed in November with a bonus of 10% of the money committed to that option, but to community leaders. The community leaders can then decide how to disburse the money according to their discretion or the community's need. It is intended to address risks that index insurance cannot or should not address, such as inconsistent rainfall or other destructive events like hail, floods, or damage from pests and wildlife.

During the game, there was no time scheduled for group discussion of potential contributions to the community risk pool, so each contribution to the community fund was made on an individual or decentralized basis. Also, the community risk pool option had no enforcement mechanism to ensure participation at the time of decision-making.

In each game session, participants asked about scenarios that could be described as basis risk (irregular rainfall) or idiosyncratic risks like termite infestation. In each case, the participants were referred to the community risk pool as a mechanism for addressing the risks that the index insurance did not cover.

4) Index insurance

The *index insurance option* consisted of two types of index insurance, offered exclusively of each other. If they wanted to purchase index insurance, participants needed to choose the frequency with which the insurance provided payment. The "high frequency" contract offered a frequency configured to pay out in one of three years, and the "low frequency" contract was designed to pay out in one of five years.

These options were, for most intents and purposes, live insurance contracts that would be resolved at the conclusion of the growing season based on the rainfall observed over the course of the year. The only difference between these simulated contracts and a commercial product is that the loading percentage was not priced by an insurance company. To simulate the involvement of such an entity, a loading percentage of approximately 50% was added to the cost of the contract to account for the costs of holding risk.

To demonstrate the difference between the two options, a series of practice rounds were conducted in each village. To simulate the rainfall in a given season, a ball was chosen from a box that was one of three colors: green, yellow, and red. The balls appeared in amounts that are listed in the table below. The green ball represented a good year, the yellow ball a dry year, and the red ball a very dry year. Either a yellow or red ball triggered the "High Frequency" insurance (5 balls in 15),

while the "Low Frequency" insurance was only triggered by a red ball (3 balls in 15). The payouts as conveyed included an explicit loading price of about 50% of the premium paid. Therefore, the "high frequency" option designed to pay out once in three years were demonstrated to have a payout of 2x the premium, and the "low frequency" option designed to pay out once in five years were demonstrated to have a payout of 3x the premium.

[Table 3 about here]

Only maximum payouts were demonstrated in the game to facilitate understanding, but partial payouts were possible based on the exact rainfall amount. The historical schedule of payouts were presented alongside the technical parameters for each village's contract, including timing, dekadal cap, trigger, and exit. These were printed on a poster and presented to the assembled participants along with a list of historical years in which those contracts would have paid out.

It should be noted that the expectation of payouts between the two insurance options were identical, however the difference is in the variance of the payout. In this case, each 5 birr increment of insurance had an expected payout of 3.3 birr, with the discrepancy due to the simulated loading costs. In essence, over the fifteen year period for which the contract has been configured, the essential question boils down to: Would you rather receive the insurance payouts in the three worst years, or the five worst years?

This design is very close to the actual commercial insurance products, even though the design of the contracts was largely identical. In the commercial sign-ups, the customers were asked how much they would like to buy in terms of maximum liability as well as the frequency of the payouts. In this regard, the high frequency insurance would appear to have a higher price point than the low frequency insurance, as the cost of insuring the same maximum liability for more frequent events costs more money. In the game, the price point might be seen as identical, since the participants could only allot portions of their endowment in 5-birr increments.

Several practice rounds were conducted to convey the concepts of the game and demonstrate the consequences of investing money in each option in different types of years. After this, the participants were able to place their endowments into the categories for actual money that would be resolved after the growing season was finished.

5. Results and Discussion

Much of the debate about demand for index insurance centers on the notion of take-up rates as a gauge of total demand. Our game is not set up to weigh in on this debate as the endowment given to the participants does not simulate a real-world market transaction. There are several potential reasons for this, including the

absence of liquidity constraints as well as the ability to buy index insurance in very small amounts (5 birr – about $0.30). Over 99% of participants bought some amount of index insurance, a figure that is clearly unrealistic in a market setting.

This game is most useful in comparing preferences for the risk management relative to each other, as each 5 birr allocation necessitated the exclusion of all other options. In particular, the high and low frequency insurance were offered independently of each other, so it is not a question of the amount of money placed in each option, but rather a preference between the two options.

Analysis of the relative frequencies that are chosen will start to map out risk management preferences. There is a fine distinction between the types of payments that are possible, especially in the second period, and in essence the participants are choosing the timing and amounts of the payments they would prefer. If more granular choices as to the timing of payments had been offered (i.e. 1 in 4 years, etc.), it might be possible to map out a complete set of preferences for smoothing risk.

That said, there are several conclusions that may be drawn from the data:

[Table 4 about here]

- *High frequency payouts were strongly preferred to low frequency payouts.*

  86% participants in the game chose the high frequency payouts compared with 13% who chose the low frequency payouts (as well as 1% who chose to buy no insurance). The high-frequency payouts, as demonstrated in the practice rounds, require a premium of 50% of maximum liability, as compared to 33% for the low-frequency payouts.

  This result runs counter to prevailing thoughts about insurance pricing, in which it is assumed that there is downward pressure on prices. The baseline for most insurance products, such as life insurance, is a very small percentage of maximum liability, which reflects the relatively rare nature of the event. This result clearly shows that people are willing to pay more for index insurance if they receive more coverage.

[Table 5 about here]

- *The index insurance option was strongly preferred to the savings option*

  The savings option provides a sure payment, but may not provide enough of a return to address financial needs at the end of the season. That farmers chose to invest in index insurance rather than savings shows that they are hedging risk with the purchase of a risk-contingent payout option.

It is likely that the return rate on money invested in farm inputs exceeds the 10% rate that was offered on the savings option. In this way, the rate may have been inadequate, artificial as it was. Time preference for money is one focus of follow-up activities for the 2011 season.

- *The two most popular options (by amount allocated) were keep the money and the index insurance option*

We see that it was common for participants to spread out their endowment to multiple options, which seems to be evidence of a risk hedging strategy using a portfolio of investments. However, there are several clear trends in the popularity of each option.

Few people contributed small amounts to the index insurance option, as the majority contributed in excess of 20 birr to the option, representing more than 25% of the endowment that they were given. The only other option that rivals this percentage is the *Keep the Money* option. The most popular contribution for both the insurance option and the keep the money option was 20 birr.

In some ways, this makes sense: the payout from the community risk pool is the most uncertain of all, as it depends on the presence of an idiosyncratic risk event, cooperation from other participants that contributed, as well as the approval of community leaders to recoup the investment.

[Table 6 about here]

- *In some cases, the insurance option was more popular than taking home that day.*

In the Raya Azebo sites, Geneti and Hade Alga, people contributed more total money to the index insurance options than they chose to take home with them that day. This may have been heavily influenced by production decisions, as in these places the planting was already underway and it was not as timely to invest money in their fields. Seemingly, at the point in time that the games were conducted, participants saw more utility in reducing the variance of their future income than self-insuring with immediate payments.

There may be some question as to whether or not these results are an artifact of the game design, as people can be expected to behave differently when it is their own money that they are spending. In this case, the actual sign-up data for the project will prove to be a useful tool in deciphering the demand preferences of the smallholder farmers. And in fact, the preference for high frequency insurance is preserved in the commercial sign-up statistics.

[Table 7 about here.]

The estimated take-up rates that result from taking a ratio of purchasers to total tabia population is:

Adi Ha	29%
Awet Bikalsi	36%
Geneti	6%
Hade Alga	12%
Hadush Adi	31%

These take-up rates are rather high compared to the rates observed in other projects, but that is largely because purchasers were allowed to pay the premium in either cash or labor. Participants in the Productive Safety Net Program (PSNP) are considered to be the most vulnerable, and are eligible to work a certain number of days every year during the dry (non-cropping) months. These activities are designed to reduce risk and make populations more resilient. Although this means that the premium is paid by a third party, it should not necessarily be viewed as a strict subsidy, as the participants in the PSNP program are paid less than half market wages for their labor. Rather, the PSNP program helps circumvent liquidity constraints, and may be further evidence that those liquidity constraints seriously inhibit demand for index insurance.

In the commercial sign-up, sales were not bundled with loans or tied to any other financial product, and buyers were able to choose the coverage level they desired. In many projects, the coverage of the index insurance is often configured to cover the cost of the inputs used (Mapfumo 2007). Farmers in the actual sign-up purchased insurance with a maximum payment in excess of the reported costs of their inputs, yet another sign that demand for this product was considerable.

An interesting facet of the experimental game results is the high percentage (88-90%) of people that contributed some money to the community risk pool in Geneti and Hade Alga. The frequency of contributions was greater than in Awet Bikalsi and Adi Ha, but the total value of those contributions was not appreciably greater, as most participants contributed near the minimum discrete amount to the community risk pool option (5 birr). Since this decision was made independently and was not a group decision, this likely represents to some degree the amount of trust that people had in local community groups. And in fact, anecdotal evidence indicated that the Raya Azebo villages that had those high percentages were the ones with more active, well-organized community farming associations.

Upon the receipt of the community risk pool funds during the visit in November, the community leaders indicated that they intended to use the payment as seed capital for local farmers. The leaders also indicated their intention to ask for contributions either in cash or in kind from those that had not contributed to the community risk fund during the game activities.

Lastly, there is evidence that the demand for index insurance relied heavily on the participants' production decisions. Purchases of index insurance in the games was much higher in the Raya Azebo area, which differed from the Kola Tembien area in that the crop had already been planted by the time the research staff arrived. In November, in an attempt to explain the differences between villages, the research staff asked several questions about production decisions as detailed in Table 8. The answers to those questions indicate that the money participants chose to keep from the games was invested in seeds and/or fertilizer at a much higher rate in Kola Tembien. It seems that since it was still possible to invest in productive activities

[Table 8 about here]

6. Conclusions

This paper describes a series of games that were played in the Tigray region of Ethiopia in 2010 concerning the issue of demand for weather index insurance. This game involved an insurance contract which was resolved by actual rainfall observations and was virtually identical to the commercial products sold in the region. In these games as well as the commercial sales of the product, demand for index insurance was seen to be high, even among the poorest of the poor.

The participants have indicated a preference for lower variance in income with their decision to choose the index insurance with more frequent payouts. Participants also showed a preference for risk-contingent payouts over the sure payout of an interest-bearing account. The contributions to a community risk pool designed to address idiosyncratic risks varied greatly between study sites but could also be as high as 90% in some areas.

Liquidity constraints are still demonstrated to be a major issue that will need to be addressed by index insurance practitioners. Both this game and the commercial sign-up were able to alleviate some of those liquidity constraints, and experienced higher levels of participation than other researchers have observed. This includes a sensitivity to timing, as the results form the games show that farmers in areas that had finished planting were much more likely to buy index insurance and much less likely to use the money they kept for seeds and/or fertilizer.

These results give rise to many questions about the preferences of farmers for risk management implements and the interaction between them. Future research needs to continue so that researchers can unravel the linkages between credit, savings, and insurance.

References

Bhattamishra, R., and C. B. Barrett, 2009. "Community-Based Risk Management Arrangements" USAID AMA CRSP BASIS Brief.

Binswanger, H. (1980). "Attitudes Towards Risk: Experimental Measurement in Rural India." *American Journal of Agricultural Economics* 62(3):395-407.

Binswanger-Mkhize, H. (2011) *Journal of Development Studies,* in press.

Chen, J., T. Dinku, E. Holthaus, B. Lyon, M. Madajewicz, C. Mullaly, M. Norton, D. Osgood, A. Pascualini, S. Pant, N. Peterson, R. Saavedra, J. Sharoff, K. E. Shirley, C. Small, S. Stiffel, and T.-L. Teh, 2010: HARITA IRI Report to Oxfam America - Final Report for IRI MIEL Planning & Technical Support for HARITA - Micro-Insurance Pilot USA 536 /09 - June 2010. IRI Technical Report 10-08, IRI, Palisades, 44 pp.

Cole S, X. Giné, J. Tobacman, P. Topalova, R. Townsend, J. Vickery (2009). Barriers to household risk management: evidence from India. Work. Pap., Fed. Res. Bank New York

Dercon, S., J.De Weerdt, T.Bold, and A.Pankhurst. (2006) "Group-based Funeral Insurance in Ethiopia and Tanzania." *World Development*, vol. 34, no.4, April, pp 685-703.

Giné, X. R. Townsend, and J. Vickery (2008) "Patterns of Rainfall Participation in Rural India." *The World Bank Economic Review*, Vol. 22, No. 3, pp. 539–566

Giné, X. and D. Yang (2009) "Insurance, credit, and technology adoption: Field experimental evidence from Malawi." *Journal of Development Economics* Vol. 89(1): 1-11

Giné, X.(2011) "Can We Boost Demand for Rainfall Insurance in Developing Countries?" All About Finance. World Bank blogs. http://blogs.worldbank.org/allaboutfinance/node/634 Accessed April 18, 2011.

Hazell, P., Anderson, J., Balzer, N., Clemmensen, A., Hess, U. & Rispoli, F (2010) "The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihoods." International Fund for Agricultural Development and World Food Programme.

Hellmuth M.E., Osgood D.E., Hess U., Moorhead A., and Bhojwani H. (eds) 2009. Index insurance and climate risk: Prospects for development and disaster management. Climate and Society No. 2. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA.

Hill, Ruth (presenter) (2010) "Rainfall Insurance and Informal Groups: Evidence from a Field Experiment with Funeral Societies in Ethiopia." Presentation to 6th Annual Microinsurance Conference, Manila, Philippines, November 2010.

Ligon, E. (2009) "Risk management in the cooperative contract." *American Journal of Agricultural Economics*, 91(5):1211.

Lybbert, T.J., Galarza F., McPeak J., Barrett C.B., Boucher S., Carter M.R., Chantarat S., Fadlaoui A. and A.G. Mude. 2010. "Dynamic Field Experiments in Development Economics; Risk Valuation in Morocco, Kenya and Peru." *Agricultural and Resource Economics Review* 39(2): 176-192.

Mapfumo, S. (2007) "Weather Index Insurance: The Case for South Africa." Micro Insurance Agency (MicroEnsure). Prepared for FinMark Trust.

Meze-Hausken E (2004) "Contrasting climate variability and meteorological drought with perceived drought and climate change in Northern Ethiopia." *Climate Research* 27:19–31

Peterson, N., & Mullally, C. (2009). Index insurance games in Adi Ha Tabia, Tigray Regional State, Ethiopia. Final report to Oxfam America, Boston, USA.

Skees, J.R. (2008). "Innovations in Index Insurance for the Poor in Lower Income Countries." *Agricultural and Resource Economics Review* 37/1:1-15.

Turvey, C.G. (2001). "Weather Insurance and Specific Event Risks in Agriculture." *Review of Agricultural Economics* 23(2):333-351.

Vargas-Hill, R. (2009) "Using Stated Preferences and Beliefs to Identify the Impact of Risk on Poor Households." *Journal of Development Studies* 45(2):151-171.

Vedenov, D.V., and B.J. Barnett. (2004). "Efficiency of Weather Derivatives as Primary Crop Insurance Instruments." *Journal of Agricultural and Resource Economics* 29(3): 387-403.

Yesuf, M. and R.A. Bluffstone (2009) "Poverty, Risk Aversion, and Path Dependence in Low-Income Countries: Experimental Evidence from Ethiopia." *American Journal of Agricultural Economics* 91(4): 1022-1037.

Tables and Figures

Table 1: Summary Statistics for Participants

	Mean	Standard Dev.
Male	0.67	-
Age	41.31	13.09
Years of School	1.70	2.77
Rainfed Land Owned (ha)	3.47	2.46
Rainfed Land Worked (ha)	3.37	2.64
Irrigated Land Owned (ha)	0.33	0.52
Irrigated Land Worked (ha)	0.33	0.53
# Oxen Owned	1.05	0.93
Children in Household	2.98	1.82
Muslim	0.15	-

Table 2: Description of Study Sites

	Area 1	**Area 2**
Villages Visited	Adi Ha, Awet Bikalsi	Geneti, Hade Alga
Location in Tigray	Central	Southern
Main Crop	Maize	Sorghum
Mean Rainfall/year		
Critical Period Begins*	May 1st	April 11th
Critical Period Ends*	June 30th	June 11th
Critical Period Begins*	August 21st	July 1st
Critical Period Ends*	September 20th	September 10th
*: According to farmer interviews		

Table 3: Number of balls and simulated payouts for each option

Color	# of balls	Represents	Simulated Payout - High Frequency	Simulated Payout - Low Frequency
Green	10	Good Season	None	None
Yellow	2	Dry	2x	None
Red	3	Very Dry	2x	3x

Table 4: Detailed games results

Totals (birr)					

	Keep	Savings	Community	High Frequency	Low Frequency
Adi Ha	4195	880	280	1405	90
Awet Bikalsi	3290	1505	455	2195	50
Geneti	1800	1240	750	2495	585
Hade Alga	1910	1310	825	2145	745

Percentage of Total Spent					
	Keep	**Savings**	**Community**	**High Frequency**	**Low Frequency**
Adi Ha	61.24%	12.85%	4.09%	20.51%	1.31%
Awet Bikalsi	43.90%	20.08%	6.07%	29.29%	0.67%
Geneti	26.20%	18.05%	10.92%	36.32%	8.52%
Hade Alga	27.54%	18.89%	11.90%	30.93%	10.74%

Percentage of Participants Putting Some Money Into That Option					
	Keep	**Savings**	**Community**	**High Frequency**	**Low Frequency**
Adi Ha	100.00%	77.55%	34.69%	91.84%	4.08%
Awet Bikalsi	100.00%	99.07%	56.07%	97.20%	2.80%
Geneti	95.92%	97.96%	88.78%	78.57%	21.43%
Hade Alga	100.00%	97.98%	89.90%	75.76%	24.24%

Percentage of People Buying Index Insurance	
Adi Ha	95.92%
Awet Bikalsi	100.00%
Geneti	100.00%
Hade Alga	100.00%

Table 5: High Frequency versus Low Frequency insurance decisions

Experimental Games				
	Participants	**High Frequency**	**Low Frequency**	**None**
Adi Ha	98	90	4	4
Awet Bikalsi	107	104	3	0
Geneti	98	77	21	0
Hade Alga	99	75	24	0
Percentage		**86.07%**	**12.94%**	**1.00%**

Table 6: Number of contributions ≥ 20 birr for each option

Number of Contributions ≥ 20 birr			
Option	**Total**	**≥ 20 birr**	**%**
Keep	402	325	81%
Savings	402	100	25%
Community Savings	402	14	3%
High Frequency	346	259	75%
Low Frequency	52	50	96%

Table 7: Sign-up data for High Frequency and Low Frequency options

Sign-Up Data			
	# Policies Bought	**High Frequency**	**Low Frequency**
Adi Ha	334	325	9
Awet Bikalsi	269	249	20
Geneti	135	87	48
Hade Alga	198	195	3
Hadush Adi	372	366	6
Percentage		**93.43%**	**6.57%**

Table 8: Selected responses to survey questions

When the games were conducted, were you finished planting your crops for this year?			
	Yes	**No**	**% Yes**
Adi Ha	15	66	18.5%
Awet Bikalsi	19	77	19.8%
Geneti	36	37	49.3%
Hade Alga	57	31	64.8%
Did you use any of the money that you received from the games for fertilizer or seeds?			
	Yes	**No**	**% Yes**
Adi Ha	76	5	93.8%
Awet Bikalsi	88	8	91.7%
Geneti	29	44	39.7%
Hade Alga	35	53	39.8%