The Impact of Rainfall Index Insurance in Amhara, Ethiopia

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Ethiopian Project on Interlinking Insurance & Credit for Agriculture (EPIICA):

Project is a collaboration between researchers and:

- Nyala Insurance Company (largest insurer in country)
- Dashen Bank (largest private-sector bank in country)
- Ethiopian Economics Association (fieldwork/analysis).

Purpose of project is:

- to test impact of rainfall insurance in one of the most drought-exposed farming populations in world.
- to understand the extent to which interlinking credit and insurance (rainfall-contingent loans) can unlock demand for inputs in smallholder agriculture

Standalone Insurance:

- Sold through primary (village-level) cooperatives to members at time of purchasing inputs.

- Framed as input insurance, meaning that it would cover cost of inputs if rain fails.

- Payoffs with trigger/exit for each of three crop phases, optimized separately for maize, sorghum, teff, and wheat for each insured station.

- Only households in villages whose center is less than 15km from an insured station offered insurance.

Interlinked Insurance:

- Cooperative Unions (collectives of village-level cooperatives) are used as credit intermediaries.

- Each CU signs single loan contract with Dashen, is made beneficiary of Nyala insurance policy.

- Pushes the CUs into new role, asking them to take collateralized loans with collective assets.

- Premium must be paid up front for either product.

- Can only get the interlinked loan if insurance purchased, but can choose standalone product also in interlinked arm.

Problems in the Interlinked Arm:

- Cooperative Unions reluctant to take on risk of loans, particularly as government has typically provided credit to their members.

- Heavy state involvement in credit sector, negative real interest rates.

- Unpredictable role of government in smallholder input financing: 'the game of chicken'.

- Bureaucratic delays in screening of collateral, account opening, etc.

Interlinked credit could not be executed in either the first or the second year's sales windows.

Interlinked arm is standalone from an impact perspective.

Research design, intended and actual:

Original sample:

120 kebeles: 40 control, 40 standalone, 40 interlinked.

However, not all turn out to be deficit-rainfall threatened.

Drought-threatened sample:

84 kebeles: 27 control, 29 standalone, 28 interlinked

However, Swiss Re refuses all but 7 stations.

Drought-threatened insurable sample 'Experimental':

49 kebeles: 15 control, 17 standalone, 17 interlinked

However, not all kebeles achieve any sales.

Kebeles with sales versus expanded control: 'Power':

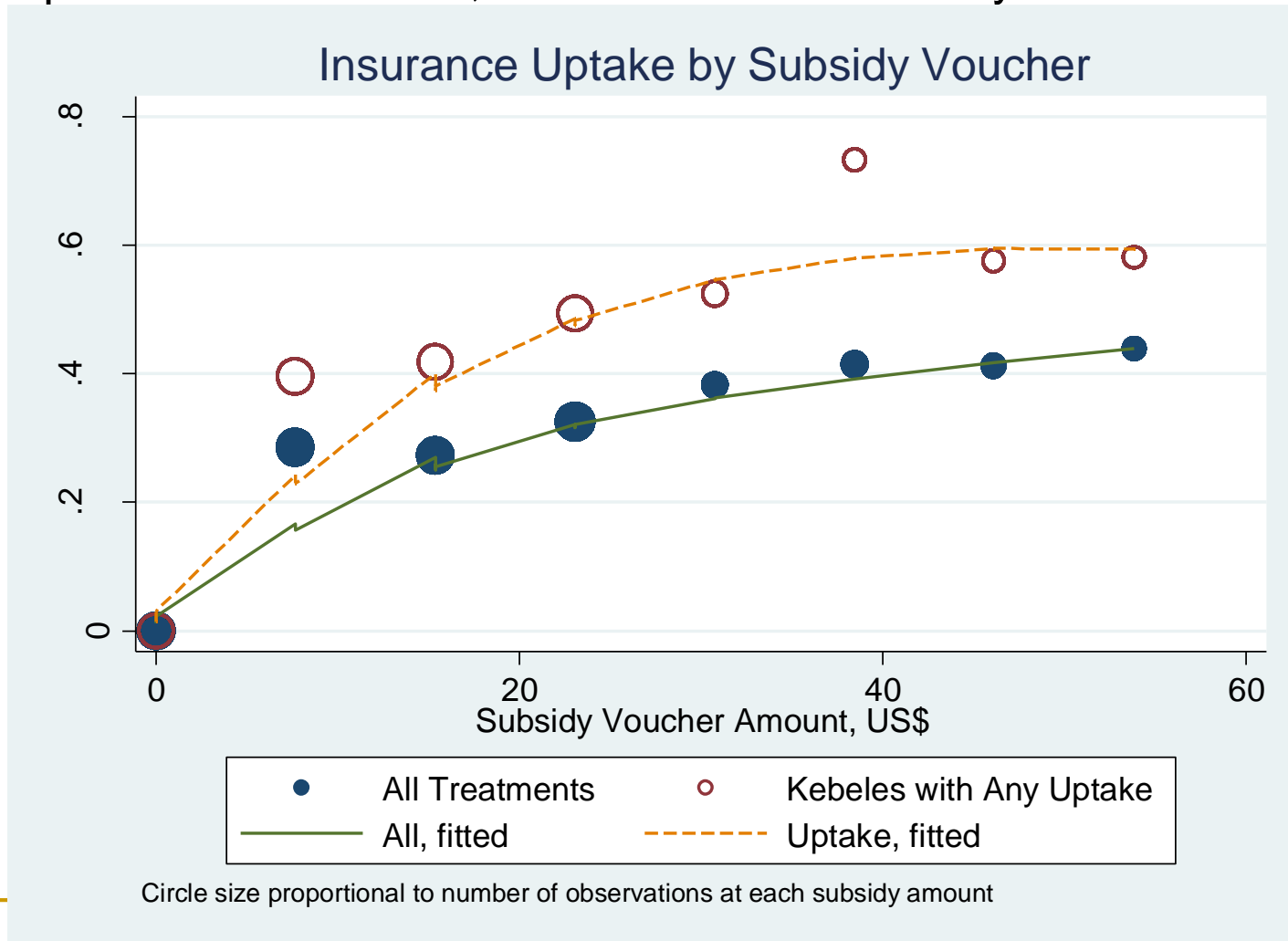62 kebeles: 39 control, 13 standalone, 10 interlinked

No interlinking achieved in first year of sales.

'Experimental':   15 control vs. 34 treatment
'Power':   39 control vs. 23 treatment

The Individual-level Voucher Experiment:
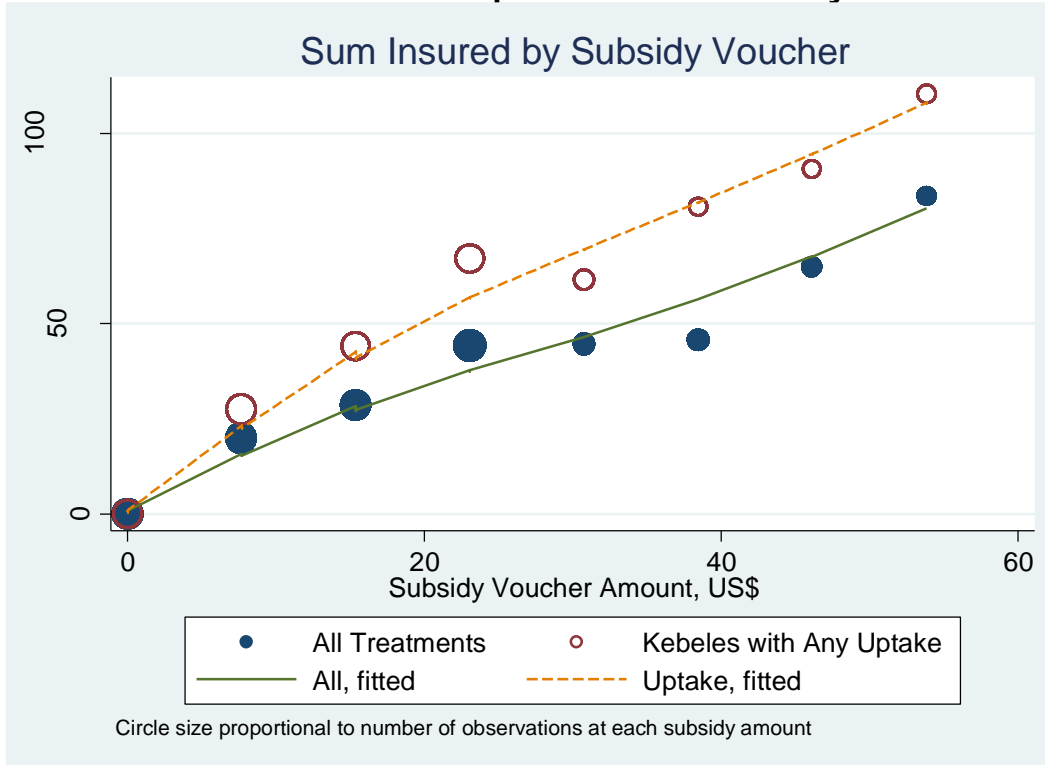
- To understand the demand curve, and to create individual-level experimental variation, we conducted a subsidy voucher lottery.

Insurance Uptake by Subsidy Voucher

Legend:
- ● All Treatments
- ○ Kebeles with Any Uptake
- —— All, fitted
- - - - Uptake, fitted

X-axis: Subsidy Voucher Amount, US$

Circle size proportional to number of observations at each subsidy amount

The Individual-level Voucher Experiment:

- Only 21% of farmers put any of their own money into purchase; most took the voucher and purchased only that much coverage.

Sum Insured by Subsidy Voucher

Circle size proportional to number of observations at each subsidy amount

- This is an experiment in giving away insurance coverage.
- Quantity of coverage ~ directly randomized at individual level.

The Individual-level Voucher Experiment:

The voucher lottery turns out to be critical for two reasons:

1. Uptake without a voucher was exactly 0; bad for the product but good for identification.

2. The ICCs for fertilizer expenditures, the core outcome, turn out to be as high as .8 in some rounds (!!).

Given these, simple way to way to analyze experiment is to include dummy for 'any voucher' as well as a dummy for treatment.

- Voucher dummy then gives the ITT of being offered a voucher, treatment dummy like balance test.

- Given ICCs, individual SEs typically less than half those estimated cross-cluster.

Uptake across two years:

Year 1 sales window, studied in this presentation:

- offered subsidies only to the study sample.
- Uptake among those offered subsidies was 34%
- Uptake rate <.5% among the broader population not offered subsidies.

Year 2 sales window, for which we just received data (post-treatment survey to be conducted in Jan-Feb 2014):

- subsidy experiment in whole membership of coop
- vouchers of 0, $6, and $12:
- More than 5,000 contracts written by Aug 2013.
- Uptake rate in subsidized sample ~ 41%
- Uptake rate in unsubsidized sample ~ 3%.

Timeline for this analysis:

Paper uses three rounds of surveys to analyze the Year 1 Sales Impact.
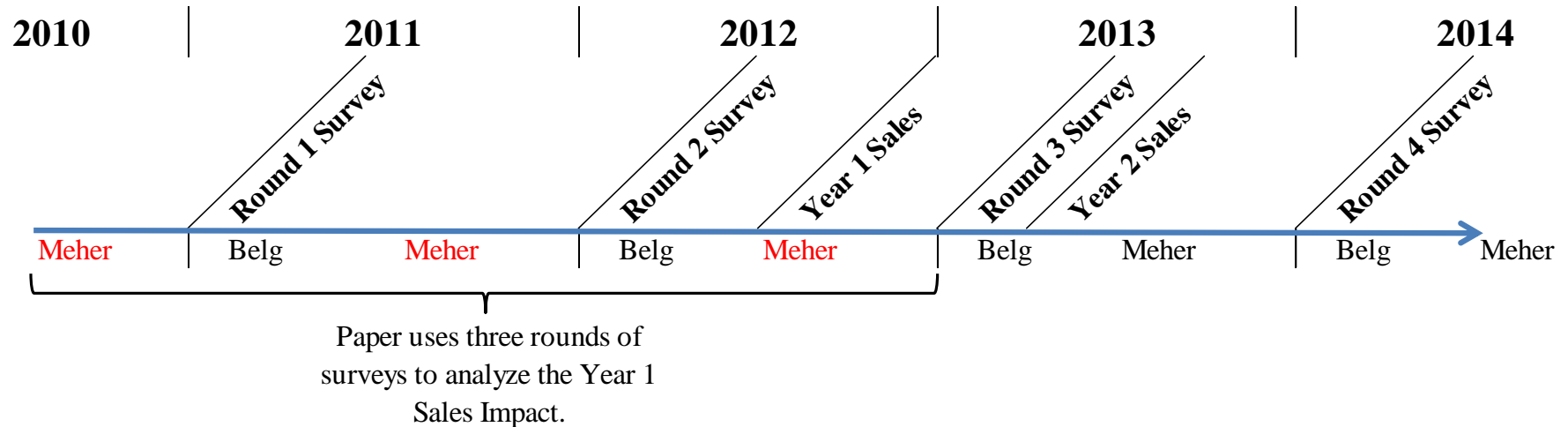
- Two baseline surveys and one follow-up survey.
- Use only Meher planting seasons since this is the only one that could have been affected by Year 1 sales in R3 survey
- Simple round 3 differences and panel DID estimators provide very similar results.

Balance in the Original Sample:

Panel A: Original Sample of 120 Kebeles.

	Uses any chemical fertilizer	Uses any improved seeds	Total hectares of land farmed	Teff yields (Kg per hectare)	Cash farm income	Total farm income
Received Voucher in Treatment	0.023	-0.0301	0.0901	40.2	-218.2	-374.6
	(0.034)	(0.027)	(0.063)	(44.870)	(267)	(601)
Treatment - Control Difference	0.0108	0.0242	-0.281*	-48.33	644.4	1675
	(0.080)	(0.067)	(0.149)	(92.520)	(545)	(1050)
Baseline Mean in Control	0.582***	0.290***	1.669***	711.4***	2,143***	3,972***
	(0.061)	(0.050)	(0.130)	(71.890)	(371)	(471)
Observations	2,160	2,160	2,160	1,260	2,160	2,160

Preliminary results: please do not circulate.

Balance in the 'Experimental' Sample:

Panel B: Drought-affected within 15 km of reinsured station (the 'Experimental' Sample)

	Uses any chemical fertilizer	Uses any improved seeds	Total hectares of land farmed	Teff yields	Cash farm income	Total farm income
Received Voucher in Treatment	-0.0278	-0.0714*	0.141	22.1	-666.5	-1217
	(0.056)	(0.042)	(0.136)	(52.430)	(548)	(1330)
Treatment - Control Difference	0.174	0.121	-0.590*	-10.86	1462	3928
	(0.129)	(0.125)	(0.317)	(169.000)	(1110)	(2351)
Baseline Mean in Control	0.451***	0.327***	2.060***	650.6***	2,668***	4,228***
	(0.102)	(0.103)	(0.279)	(147.700)	(744)	(874)
Observations	847	847	847	594	847	847

Balance in the 'Power' Sample:

Panel C: Cooperatives with any sales versus the expanded control (the 'Power' Sample)

	Uses any chemical fertilizer	Uses any improved seeds	Total hectares of land farmed	Teff yields	Cash farm income	Total farm income
Received Voucher in Treatment	-0.00737	-0.0439	0.282*	16.76	-150.4	-1131
	(0.067)	(0.035)	(0.164)	(52.270)	(357)	(1167)
Treatment - Control Difference	0.0352	-0.00982	-0.232	-99.56	531.4	1343
	(0.125)	(0.101)	(0.258)	(131.400)	(908)	(1564)
Baseline Mean in Control	0.502***	0.338***	1.709***	680.9***	2,808***	4,458***
	(0.074)	(0.069)	(0.174)	(85.510)	(504)	(599)
Observations	883	883	883	591	883	883

Impacts: Fertilizer Use

Changes in Fertilizer Use in the Experimental Sample.

Intention to Treat in reduced experimental sample, Single Difference in R3

	Uptake of Insurance	Any chemical fertilizers used	Number of crop/plots on which chemical fertilizers used	Fertilizer Purchased per hectare		Fertilizer Used per hectare		
				Urea	Dap	Urea	Dap	Total
Any Voucher	0.34211***	-0.0563	-0.137	-2.351	-5.909	-2.757	-6.7	-10.87
	(0.055)	(0.041)	(0.141)	(3.350)	(4.768)	(3.443)	(4.916)	(7.893)
Treated	-0.00000***	0.128	0.412	10.79*	6.065	11.04*	6.305	19.1
	0.000	(0.081)	(0.332)	(6.113)	(7.584)	(6.242)	(7.648)	(12.780)
R3 Mean in the Control	0.00000***	0.716***	1.432***	15.87***	20.16***	15.78***	20.11***	35.78***
	0.000	(0.070)	(0.253)	(3.659)	(5.369)	(3.676)	(5.389)	(8.766)
Observations	847	847	847	790	790	790	790	790
R-Squared	0.178	0.010	0.010	0.012	0.003	0.011	0.004	0.008

- ❑ No uptake outside of voucher group within the study sample.
- ❑ Negative coefficients on fertilizer use
- ❑ Power is a problem: MDE for 'Any chemical fertilizer' is 8pp off a base of 71.6%
- ❑ Individual-level voucher effect MDE is half that of the village-level treatment.

Preliminary results: please do not circulate.

Fertilizer Use in the 'power' sample:

Intention to Treat in 'power' sample, Difference in Differences across rounds

	Uptake of Insurance	Any chemical fertilizers used	Number of crop/plots on which	Fertilizer Purchased per hectare		Fertilizer Used per hectare		
				Urea	Dap	Urea	Dap	Total
Offered Voucher in Round 3	0.506***	-0.053	-0.0927	-3.277	-2.044	-3.429	-1.58	-4.518
	(0.054)	(0.088)	(0.123)	(5.37)	(7.72)	(5.22)	(7.84)	(12.83)
Treatment Effect in Round 3	0	0.0927	0.0469	2.263	1.956	3.156	2.411	4.939
		(0.112)	(0.197)	(6.63)	(11.78)	(6.67)	(12.06)	(19.22)
Offered Voucher (Pre-treatment	0	-0.00737	-0.0582	4.78	-2.9	4.773	-3.626	0.705
		(0.067)	(0.105)	(3.90)	(7.47)	(3.73)	(7.51)	(11.78)
Treated (Pre-treatment differenc	0	0.0352	-0.0121	-0.17	-0.0183	-0.811	-0.27	-0.51
		(0.125)	(0.200)	(9.04)	(14.75)	(9.14)	(15.03)	(23.55)
Round 2	0		-1.074***					
			(0.160)					
Round 3	0	0.191***	0.461***	-8.474*	-13.20**	-9.482**	-14.40**	-24.77**
		(0.064)	(0.126)	(4.51)	(6.34)	(4.59)	(6.50)	(10.89)
Baseline Mean in the Control	0***	0.502***	1.101***	26.38***	33.26***	27.02***	34.33***	62.30***
	0.000	(0.074)	(0.188)	(5.65)	(8.48)	(5.81)	(8.74)	(14.29)
Observations	2,649	1,766	2,649	1,688	1,688	1,688	1,688	1,688
R-Squared	0.472	0.052	0.249	0.013	0.023	0.014	0.025	0.021

- ❑ Results are similar to experimental DID.
- ❑ No increase in precision from the 'power' sample
- ❑ Remainder of analysis uses R3 single difference in 'experimental' sample.

Impacts: Fertilizer Use by Voucher Amount

Changes in Fertilizer Use with Sum Insured

Slope term in experimental sample, Single Difference in R3

	Uptake of Insurance	Any chemical fertilizers used	Number of crop/plots on	Fertilizer Purchased per		Fertilizer Used per hectare		
				Urea	Dap	Urea	Dap	Total
Voucher Amount, US $	0.00394**	-0.000859	0.000383	0.114	0.0399	0.109	0.0642	0.171
	(0.002)	(0.001)	(0.003)	(0.11)	(0.11)	(0.11)	(0.11)	(0.21)
Any Voucher	0.24061***	-0.0342	-0.147	-5.25	-6.925	-5.539	-8.335	-15.21
	(0.061)	(0.039)	(0.161)	(4.76)	(5.22)	(4.85)	(5.45)	(9.67)
Treated	0	0.128	0.412	10.79*	6.065	11.04*	6.305	19.1
	(.)	(0.081)	(0.332)	(6.12)	(7.59)	(6.25)	(7.65)	(12.79)
R3 Mean in the Control	0.00000**	0.716***	1.432***	15.87***	20.16***	15.78***	20.11***	35.78***
	0.000	(0.070)	(0.253)	(3.66)	(5.37)	(3.68)	(5.39)	(8.77)
Observations	847	847	847	790	790	790	790	790
R-Squared	0.190	0.010	0.010	0.013	0.004	0.012	0.005	0.009

- ❑ Despite negative effect of receiving voucher, some evidence that increasing the voucher amount increases the intensity of fertilizer use per hectare.

Impacts: Seeds

Changes in Seed Use

Intention to Treat in reduced experimental sample, Single Difference in R3

	Used Any Improved Seeds	Value of Local Seeds Used	Value of Improved Seeds Used
Any Voucher	-0.0428	-32.34	-2.688
	(0.043)	(79.550)	(45.190)
Treated	0.0289	10.54	36.49
	(0.097)	(205.100)	(82.920)
R3 Mean in the Control	0.409***	618.2***	196.4***
	(0.070)	(159.600)	(49.790)
Observations	847	847	847
R-Squared	0.001	0.000	0.001

❑ Again, weak negative treatment effects.

Impacts: Inputs

Changes in Input Use in the Experimental Sample.
Intention to Treat in reduced experimental sample, Single Difference in R3

	Total Hectares of Land Farmed	Total number of Plots Farmed	Used any Input Credit	Used any Chemical Pesticides or Herbicides	Household Hired in Labor for Agriculture
Any Voucher	-0.0773	-0.148	0.0299	-0.0211	-0.0557
	(0.281)	(0.209)	(0.051)	(0.057)	(0.043)
Treated	-0.15	0.367	-0.0043	0.169*	0.117
	(0.518)	(0.350)	(0.074)	(0.101)	(0.072)
R3 Mean in the Control	3.200***	3.008***	0.233***	0.362***	0.206***
	(0.319)	(0.231)	(0.052)	(0.074)	(0.047)
Observations	847	847	847	847	847
R-Squared	0.001	0.005	0.001	0.020	0.007

❑ Slight uptick in use of agricultural credit, otherwise negative and insignificant.

Impacts: Yields

Changes in Yields in the Experimental Sample.

Intention to Treat in reduced experimental sample, Single Difference in R3

	Yields, kg per hectare for farmers planting this crop:			
	Wheat	Maize	Teff	Sorghum
Any Voucher	99.25	-57.15	-143.8*	167.8*
	(156.2)	(177.8)	(80.8)	(86.0)
Treated	49.08	24.3	173.3*	-120.1
	(113.7)	(213.8)	(95.8)	(133.6)
R3 Mean in the Control	241.6***	567.7***	334.3***	591.5***
	(36.4)	(110.1)	(41.5)	(114.3)
Observations	100	309	551	317
R-Squared	0.023	0.001	0.013	0.004

❑ Small increases in yields for the less important crops (wheat and sorghum), but a sizeable drop in the yields on the most important one (teff).

Preliminary results: please do not circulate.

Wrap-up:

- Project has many moving parts and has suffered from implementation issues.

- Year 1 insurance certainly did not have a transformative positive effect on input use, if anything a slight decrease.
  - Insurance sales were later in the planting season than intended; this mitigates against positive impact.
  - Possible that bureaucratic hurdles around receiving insured inputs delayed their use even further?
  - Payouts made in 7 out of 23 kebeles with insurance sales, 140% of premiums.

- Year 2 sales moving closer 'to scale', but uptake rates in the study sample (and therefore power) will be broadly similar.
  - Year 2 insurance offered in a more timely fashion and in all treatment cooperatives, but interlinking still not achieved.

- Year 3 sales upcoming:
  - Redouble efforts on building Dashen-CU link for interlinked arm.
  - Qualitative study of input distribution issues within kebele cooperatives, work to streamline.
  - Marketing materials to build towards unsubsidized market.