SOCIAL NETWORKS, FINANCIAL LITERACY AND INDEX INSURANCE

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Abstract. We present a randomized field experiment measuring the direct impact and social network spillovers of providing financial literacy and discount vouchers on farmers' decision to purchase index-based drought insurance. To examine this, we form clusters by grouping together geographically proximate households. Clusters were then randomly assigned to receive either a high or low intensity of each of the following treatments: financial literacy materials and discount vouchers off the price of insurance.

We find social network spillovers to the provision of financial literacy materials but no spillovers to the provision of discount vouchers on farmers' decision to purchase insurance. Specifically, receiving financial literacy materials when 60% or more of their neighbours also receive financial literacy materials, increases the likelihood that a farmer will purchase insurance by 4.3% (s.e. 2.5%) while receiving a financial literacy materials when 40% or fewer of their neighbours also receive financial literacy materials, decreases the likelihood that a farmer will purchase insurance by 2.6% (s.e. 2.5%). Looking at the discount vouchers, we find significant own effects of receiving discounts off the price of insurance on farmers' take-up decision but negligible social network effects. Our results provide suggestive evidence that financial literacy materials are efficacious in encouraging take-up when farmers' social contacts are similarly receive access to financial literacy materials.

1. Introduction

Agriculture in developing countries is characterized by a high dependence on weather and limited irrigation. Weather shocks are a major source of income fluctuation for rural households involved in agricultural activities. Research suggests that households are not fully insured against income shocks.

Weather index-based insurance products provide a means by which poor households can hedge against these risks. A significant advantage of the design of index insurance products

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is that, since payouts are based on measured rainfall, they can be calculated and disbursed quickly and automatically without the need for households to formally file a claim. This in turn reduces transaction costs, which would otherwise tend to drive up the price of the insurance. Fast payouts are also likely to be valued by policyholders in an environment where households are poor and often liquidity-constrained. A second advantage is that the product is free of adverse selection and moral hazard problems that often plague insurance markets. This is because payouts are based only on publicly observed data, rather than private information reported by the person filing claims.

Despite these benefits however, demand for index insurance has however been low (Giné et al. (2008); Giné and Yang (2009); Cole et al. (2010)). One of the reasons for the weak demand may be lack of understanding of the product. If potential buyers misunderstand or underestimate the probability and amount of payouts, then there will be little demand and little or no impact on farmer behavior. Conversely, if farmers overestimate the frequency and amount of payouts, then they are likely to be disappointed and fail to purchase insurance again in the future. Financial education can help mitigate these problems.

Evidence from Malawi (Giné and Yang (2009)) and India (Giné et al. (2008)) suggests that a lack of comprehension of index insurance indeed dampened demand for index insurance. Index insurance with its complicated triggers and payout schedules is a particularly difficult product to explain, even more so than standard insurance. There are very few studies that rigorously study the effects of different means of providing information on insurance products on take-up of insurance (A notable exception is McPeak et al. (2010)).

Social networks could also play a role in individual farmer's demand for index insurance. Studies have found that social networks play critical roles in determining a variety of individual and aggregate economic outcomes ranging from transmitting information about job networks (Granovetter (1973), Granovetter (1995); Beaman and Magruder (2009)), to being the basis for trade in non-centralized markets, the provision of mutual insurance in developing countries (Fafchamps and Lund (2003)) to mention but a few. An increasingly popular technique to identify social network effects has been using randomized experiments (for instance Duflo and Saez (2003); Angelucci and DeGiorgi (2009); Angelucci et al.

(2009); Godlonton and Thornton (2010); Miguel and Kremer (2004)) wherein a random subset of members of a social network are provided with some intervention to change their behaviour. The random variation in the behavior of some members of the social network thus induced is used to instrument for the average behaviour in the group. Under conditions presented in Imbens and Angrist (1994), an instrumental variables estimator identifies a Local Average Treatment Effect (LATE) which measures the impact of the intervention beyond the targeted group - the peer effect.

This paper presents a randomized field experiment that measures the direct impact and social network spillovers of providing financial literacy and discount vouchers on farmers' decision to purchase drought insurance. We find suggestive evidence that social networks play an important role on farmers' decision to purchase drought insurance. Receiving financial literacy materials when 60% or more of a farmer's neighbours also receive financial literacy materials, increase the likelihood that a farmer will purchase insurance by 4.3% (s.e. 2.5%). In contrast, receiving a financial literacy materials when 40% or fewer of a farmer's neighbours receive them, decreases the likelihood that a farmer will purchase insurance by 2.6% (s.e. 2.5%). Discount vouchers on the hand, have strong individual effects on purchase. Reducing the purchase price of insurance by 10% increases take up by 1.3 percentage points (s.e. 0.39 percentage points). There are, however, no spillovers from the provision of discount vouchers on farmers' take-up of insurance. Our results imply that financial literacy materials are efficacious in encouraging take-up when farmers' social contacts similarly receive access to financial literacy materials.

The remainder of the paper is organizes as follows: Section 2 describes the setting and the experiment, section 3 discusses the results and section 4 concludes.

2. Experimental Design

2.1. **Setting.** The study was carried out with coffee farmers in Rũĩrĩ and Ntima, two drought prone areas in Eastern Kenya. The enumeration area covered 14 villages: 12 villages in Rũĩrĩ and 2 villages in Ntima. Interviewers first visited all coffee growing households

within the enumeration area and collected some basic information about the household: their GPS coordinates, farm size, number of coffee trees and contact information.

Following the census, households were grouped together into clusters based on geographic proximity. Each household had a block with a 60 metre radius drawn around their GPS marker. All overlapping blocks became part of the same cluster. Households that were isolated were added to the nearest cluster.

Enumerators then revisited the households and administered a baseline survey. Column (1) of Table 1 presents some summary statistics of our study population. 70% of our study households are headed by men. The average age of the household head is 49 years with 7 years of education. We define "somewhat patient" as equal to 1 if the respondent prefers to receive KSh 1,250 ($15.63) in a month to KSh 1,000 ($12.50) today. 47.6% of respondents report understanding what insurance is. Figure 4.1 gives the chronology of the study.

[Figure 1 about here.]

[Table 1 about here.]

We test two interventions: a comic on index insurance and discount vouchers for the purchase of insurance. Randomization of treatment intensity was done at the cluster level and was orthogonal across treatments. After completing the baseline survey, enumerators administered the interventions. Each household was randomly assigned to receive a comic or not depending on what comic intensity the household's cluster was assigned. Each household was also given the opportunity to take part in a drawing for a voucher off the price of insurance. Households in high voucher intensity clusters had a 3 in 5 chance of drawing a 50% voucher, a 1 in 5 chance of a 25% voucher and a 1 in 5 chance for a 0% voucher. Households in low voucher intensity cluster had a 1 in 5 chance of drawing a 50% voucher, a 1 in 5 chance of a 25% voucher and a 1 in 5 chance of a 0% voucher. Enumerators also completed a baseline survey with survey households. Figure 4.2 illustrates the experiment design.

[Figure 2 about here.]

3. Results

This section presents estimates of the causal effect of receiving a comic and a discount voucher on farmers' decision to purchase insurance. Further since treatment intensity was assigned randomly at the cluster level we can estimate social network effects of being in a high intensity comic cluster or a high intensity voucher cluster.

We estimate:

$$\begin{aligned} BuyIns_{ij} = \beta_1 Comic_{ij} + \beta_2 Comic_{ij} \times ComicIntensityLevel_j \\ +\beta_3 ComicIntensityLevel_j + \gamma_1 Voucher_{ij} + \gamma_2 Voucher_{ij} \times VoucherIntensityLevel_j \\ +\gamma_3 VoucherIntensityLevel_j + \epsilon_{ij} \end{aligned} \tag{3.1}$$

where $BuyIns_{ij}$ is an indicator for whether household i in cluster j purchased insurance. $Comic_{ij}$ is an indicator variable for whether household i in cluster j was assigned to receive a comic, $ComicIntensityLevel_j$ indicates whether cluster j was assigned to be a high comic intensity cluster or a low comic intensity cluster. $Voucher_{ij}$ is the discount voucher drawn, $VoucherIntensityLevel_j$ indicates whether cluster j was assigned to be a high voucher intensity cluster or a low voucher intensity cluster.

Table 2 presents the results. Column (1) presents a naïve estimator that ignores spillovers by grouping together treated households in high intensity clusters with treated households in low intensity clusters. We find a modestly positive effect of comics on the likelihood of purchasing insurance and a strongly significant positive effect of voucher provision on the likelihood of purchasing insurance. A 10% discount in the price of insurance increases the likelihood of purchase by 1.3 percentage points (s.e. 0.39 percentage points). In column 2, we compare treated clusters with control clusters and thus treated and control households in treated clusters are grouped together. We find that households in low comic intensity clusters are less likely to purchase insurance, though this effect is imprecisely estimated. Households in high comic intensity clusters are more likely to purchase insurance by 3.7 percentage points (s.e. 2.3 percentage points) and households in high voucher

intensity clusters are 0.29 percentage points more likely to purchase insurance for every 10% discount on the price of insurance (s.e. 0.17 percentage points).

Finally in columns (3) and (4) we interact individual treatment with the intensity assigned to the cluster. Column (3) shows that receiving a comic in a high intensity comic cluster increases the likelihood that a farmer will purchase insurance by 4.3 percentage points (s.e. 2.5 percentage points) while receiving a comic in a low intensity comic cluster decreases the likelihood that a farmer will purchase insurance by 2.6 percentage points (s.e. 2.5 percentage points). Drawing a 50% discount voucher in a high voucher intensity cluster increases the likelihood a farmer will buy insurance by 14.9 percentage points (s.e. 4.6 percentage points) while drawing a 50% voucher in a low voucher intensity cluster increases the likelihood that a farmer will purchase insurance by 9.3 percentage points (s.e. 4.9 percentage points) though these effects are not significantly different from each other. In Column (4), we include some controls for farmer's raven score, years of education, gender, ability to read a newspaper, ability to write a letter, score for coffee best practices followed, whether or not the farmer agrees that drought is the most important risk that he/she faces, a score for whether the farmer is patient, number of coffee trees, whether the farmer understands index insurance, whether the farmer can identify 60mm in a drawing. These controls don't significantly alter the magnitude of our estimates.

Our estimates in columns (3) and (4) provide suggestive evidence that financial literacy materials are only efficacious in encouraging take-up when farmers' social contacts are similarly receive access to financial literacy materials. Our results also show that the naïve estimate in column (1) understates the impact of comic provision by conflating the impact of comics in low vs high intensity comic clusters which work in opposite directions.

[Table 2 about here.]

We find similar patterns of impact if we look at spillover effects beyond the geographical cluster. To measure how treatment density affects farmers' decision to purchase insurance, we rely on exogenous variation in the local density of treated farmers by virtue of the cluster-level randomization. Specifically, we compute the number of treated farmers residing in close proximity. We get significant spillovers from farmers living 150 meters away

that diminish as the band is expanded to 200m then 300m. If a farmer was assigned a comic, each additional farmer who receives a comic within a 150 meter radius increases the likelihood that a farmer will purchase insurance by 4.7 percentage points (s.e. 1.7 percentage points) off a base of 2 percentage points among controls. In contrast, if a farmer wasn't assigned a comic, each additional farmer who receives a comic within a 150 meter radius decreases the likelihood that a farmer will purchase insurance by 2.0 percentage points (s.e. 1.0 percentage points). These estimates are robust to adding farmer level controls in Columns (2), (4) and (6).

[Table 3 about here.]

3.1. **Follow-up Survey.** Eight months after the baseline was completed and a few months after payouts were made, we conducted a phone follow-up with respondents. On average we were able to reach about 56% of our sample. This moderate tracking rate was due to the fact that not all respondents had mobile phones and not all respondents were available during the 3 week long follow-up period. Table 4 demonstrates that receiving a voucher is mildly correlated with being more likely to be found during the follow-up.

[Table 4 about here.]

Table 5 examines the impact of the provision of the interventions on farmers' understanding of index insurance. At the baseline and at the follow-up we asked farmers the following three questions: Imagine you have bought insurance against drought. If it rains less than 70mm by the end of November, you will receive a payout of 20KSh for every mm of deficient rainfall (that is, each mm of rainfall below 70mm). Will you paid out if (a) it rains 100mm? (b) It rains 60mm (If b = Yes) How much would you receive as a payout? The knowledge score is the sum of these three questions. On average, respondents were able to answer two out of the three questions. Column (1) shows that farmers who received a comic in a low comic intensity cluster score lower on average. This could be because since not many of their neighbours received comics, they weren't able to reinforce their knowledge about index insurance.

[Table 5 about here.]

Table 6 presents regressions examining the impact of the interventions on farmers' attitudes towards insurance. We asked the same set of questions at the baseline and at the follow-up. Column (1) shows that farmers in High Comic Intensity Clusters are more likely to state that "Insurance protects you in times of emergency" by 5.7 percentage points if they received a comic and 7.5 percentage points if they didn't. These effects aren't however significantly different from each other. Farmers in both high and low intensity comic clusters are also less likely to state that "Insurance companies try to cheat people even when they have a good claim" in comparison for farmers in clusters where no-one received a comic. Finally only farmers who received discount vouchers are less likely to stage that "I don't need insurance because my family, friends or relatives provide cover when necessary".

[Table 6 about here.]

4. Conclusion

This paper presents preliminary evidence from a randomized field experiment measuring the direct impact and social network spillovers of providing financial literacy and discount vouchers on farmers' decision to purchase drought insurance.

We find social network spillovers to the provision of financial literacy materials but no spillovers to the provision of discount vouchers on farmers' decision to purchase insurance. We further find that financial materials have spillover effects on farmers' attitudes towards insurance but limited effects on understanding as narrowly measured in survey.

Our results provide suggestive evidence that financial literacy materials are efficacious in encouraging take-up when farmers' social contacts are similarly receive access to financial literacy materials.

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Figures

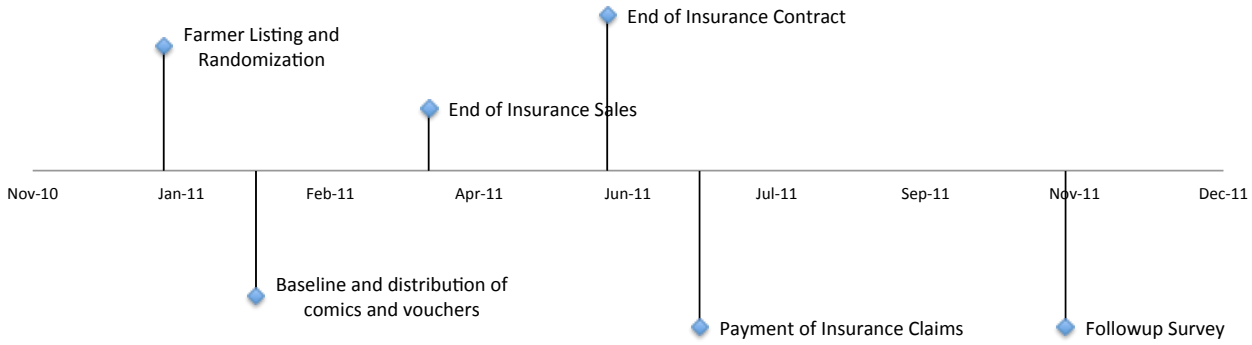

FIGURE 4.1. Study Chronology in 2011

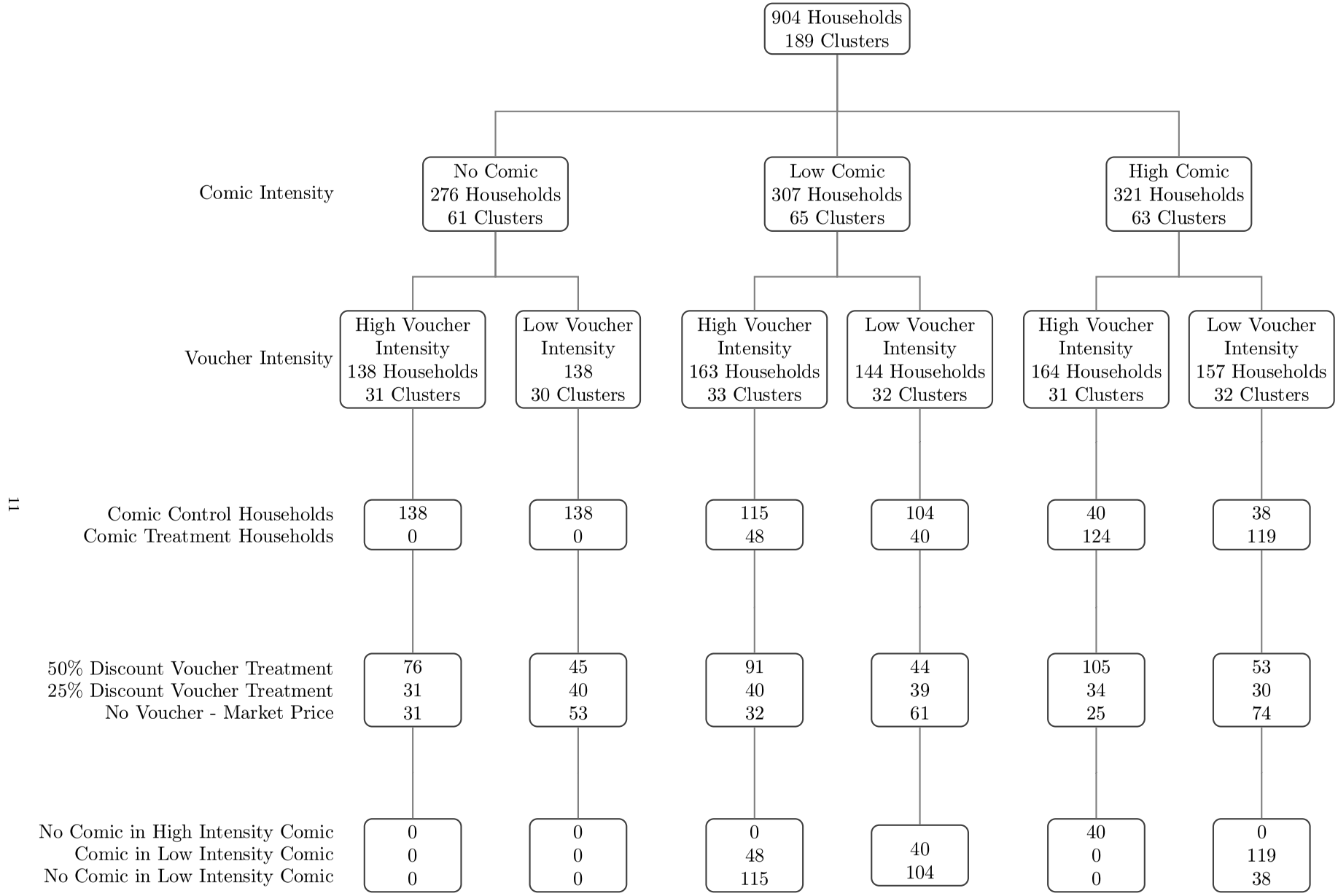

FIGURE 4.2. Randomization

TABLE 1. **Summary Statistics by Intervention**

$p-value$	Mean	Comic in High Intensity Comic Cluster	Comic in Low Intensity Comic Cluster	No Comic in High Intensity Comic Cluster	No Comic in Low Intensity Comic Cluster	Voucher in High Intensity Voucher Cluster	Voucher in Low Intensity Voucher Cluster	N
Male	0.701	0.027	−0.070	−0.036	0.062	0.104	0.087	904
0.169		(0.039)	(0.057)	(0.059)	(0.039)	(0.075)	(0.086)	
Age	48.679	1.886	−2.892	−3.459	0.41	4.47	6.585*	904
0.174		(1.714)	(2.647)	(3.035)	(1.792)	(3.530)	(3.953)	
Household Size	5.346	0.072	−0.531*	−0.332	−0.032	−0.820**	0.17	850
0.033		(0.213)	(0.292)	(0.303)	(0.214)	(0.405)	(0.493)	
Years of Education	6.682	-0.499	−1.310**	−0.751	−0.698*	0.516	1.486	904
0.156		(0.396)	(0.574)	(0.620)	(0.394)	(0.748)	(0.951)	
Able to read a newspaper	0.689	−0.043	−0.097*	−0.095	−0.019	0.048	0.143	904
0.296		(0.041)	(0.059)	(0.062)	(0.041)	(0.080)	(0.092)	
Asked for Credit in the preceding year	0.233	−0.050	−0.082	−0.039	−0.056	0.084	0.106	849
0.484		(0.039)	(0.051)	(0.056)	(0.039)	(0.071)	(0.087)	
Agrees with the statement: *Drought is the*	0.678	−0.089**	−0.041	−0.106*	−0.053	0.133*	0.209**	904
0.062		(0.041)	(0.057)	(0.062)	(0.042)	(0.080)	(0.093)	
most important risk my household faces.								
Amount spent on food in the last 7 days	1208.990	5.722	−96.776	−60.187	−61.584	−182.666	−195.997	850
0.879		(113.536)	(112.324)	(139.351)	(96.987)	(178.270)	(209.480)	
Patient	0.380	0.004	0.07	0.103	0.024	-0.018	0.089	904
0.574		(0.043)	(0.061)	(0.064)	(0.044)	(0.083)	(0.100)	
Understand Insurance	0.470	0.006	−0.033	0.142**	−0.054	0.035	0.132	849
0.104		(0.045)	(0.065)	(0.065)	(0.047)	(0.087)	(0.103)	
Total Number of Coffee Trees	0.683	0.029	−0.062	0.032	−0.006	0.065	0.175	904

TABLE 2. **Impact of Comics and Vouchers on Whether Respondents Purchased Insurance**

	Dependent Variable: Bought Index Insurance			
	(1)	(2)	(3)	(4)
Comic	0.022			
	(0.019)			
Voucher	0.131***			
	(0.039)			
Low Comic Intensity		−0.014		
		(0.020)		
High Comic Intensity		0.037*		
		(0.023)		
High Voucher Intensity		0.029*		
		(0.017)		
Comic in High Comic Intensity			0.043*	0.047*
			(0.025)	(0.025)
Comic in Low Comic Intensity			−0.026	−0.022
			(0.025)	(0.026)
No Comic in High Comic Intensity			0.026	0.032
			(0.037)	(0.037)
No Comic in Low Comic Intensity			−0.002	−0.002
			(0.023)	(0.023)
Voucher in High Voucher Intensity			0.149***	0.148***
			(0.046)	(0.047)
Voucher in Low Voucher Intensity			0.093*	0.092*
			(0.049)	(0.050)
Observations	904	904	904	904
R-squared	0.041		0.048	0.071
Mean among Controls	0.020	0.036	0	0
Village Fixed Effects	YES	YES	YES	YES
Controls	NO	NO	NO	YES

Notes: Robust standard errors, in parentheses.
* significant with 90% confidence, ** 95%, *** 99%.
Regression (4) includes controls for farmer's raven score, years of education, gender, ability to read a newspaper, ability to write a letter, score for coffee best practices followed, whether or not the farmer agrees that drought is the most important risk that he/she faces, a score for whether the farmer is patient, number of coffee trees, whether the farmer understands index insurance, whether the farmer can identify 60mm in a drawing.

TABLE 3. **OLS Regressions of Whether Respondents Purchased Insurance**

	Dependent Variable: Bought Index Insurance					
	(1)	(2)	(3)	(4)	(5)	(6)
	0-150m away		0-200m away		0-300m away	
Comic	−0.036	−0.031	−0.027	−0.020	−0.032	−0.029
	(0.025)	(0.025)	(0.028)	(0.028)	(0.032)	(0.032)
# Comics 0-Xm away	−0.020*	−0.022**	−0.010	−0.010	−0.008	−0.009
	(0.010)	(0.011)	(0.009)	(0.009)	(0.006)	(0.006)
Comic * # Comics Xm away	0.047***	0.045***	0.025**	0.023*	0.014*	0.013*
	(0.017)	(0.017)	(0.012)	(0.012)	(0.007)	(0.007)
Voucher	0.178***	0.169***	0.120**	0.110*	0.103	0.096
	(0.052)	(0.054)	(0.058)	(0.059)	(0.071)	(0.072)
# 50% vouchers 0-Xm away	0.007	0.007	0.000	0.000	−0.004	−0.005
	(0.012)	(0.012)	(0.009)	(0.009)	(0.007)	(0.007)
Voucher * # 50% vouchers Xm away	−0.028	−0.025	0.003	0.006	0.005	0.006
	(0.020)	(0.021)	(0.016)	(0.017)	(0.010)	(0.011)
# Contacts Xm away	0.008	0.008	0.004	0.005	0.005	0.005
	(0.008)	(0.008)	(0.006)	(0.006)	(0.004)	(0.004)
Observations	904	904	904	904	904	904
R-squared	0.054	0.077	0.05	0.073	0.049	0.073
Mean among Controls			0.02			
Village Fixed Effects	YES	YES	YES	YES	YES	YES
Controls	NO	YES	NO	YES	NO	YES

Notes: * significant with 90% confidence, ** 95%, *** 99%.
Robust standard errors clustered at the village level, in parentheses.
Regressions (2), (4) and (6) includes controls for farmer's raven score, years of education, gender, ability to read a newspaper, ability to write a letter, score for coffee best practices followed, whether or not the farmer agrees that drought is the most important risk that he/she faces, a score for whether the farmer is patient, number of coffee trees, whether the farmer understands index insurance, whether the farmer can identify 60mm in a drawing.

TABLE 4. **Correlates with Attrition in Follow-up Data**

Dependent Variable: Interviewed in Follow-up Survey	(1)	(2)	(3)
Comic	0.031		
	(0.035)		
Voucher	0.168**		
	(0.078)		
High Comic Cluster		−0.020	
		(0.042)	
Low Comic Cluster		0.054	
		(0.042)	
High Voucher Cluster		0.008	
		(0.034)	
Comic in High Comic Intensity			0.050
			(0.045)
Comic in Low Comic Intensity			−0.018
			(0.062)
No Comic in High Comic Intensity			0.059
			(0.066)
No Comic in Low Comic Intensity			−0.019
			(0.046)
Voucher in High Voucher Intensity			0.160*
			(0.085)
Voucher in Low Voucher Intensity			0.181*
			(0.102)
Observations	904	904	904
R-squared	0.021	0.019	0.024
Mean among Controls	0.506	0.493	0.417
F test	1.314	1.088	1.18
P-value of F model	0.186	0.361	0.267
Village Fixed Effects	YES	YES	YES

* significant with 90% confidence, ** 95%, *** 99%.

TABLE 5. **Knowledge Score on Index Insurance**

	Knowledge Score on Index Insurance at Follow-up	
	(1)	(2)
Comic in High Comic Intensity	−0.021	−0.009
	(0.044)	(0.045)
Comic in Low Comic Intensity	−0.137**	−0.127*
	(0.068)	(0.069)
No Comic in High Comic Intensity	0.041	0.067
	(0.063)	(0.063)
No Comic in Low Comic Intensity	−0.010	0.002
	(0.046)	(0.046)
Voucher in High Voucher Intensity	0.041	0.038
	(0.086)	(0.086)
Voucher in Low Voucher Intensity	0.099	0.113
	(0.101)	(0.100)
Baseline knowledge score of index insurance	0.002	(0.032)
	(0.051)	(0.058)
Observations	479	479
R-squared	0.078	0.124
Mean of Dependent Variable Among Controls	0.686	
Village Fixed Effects	YES	YES
Controls	NO	YES

* significant with 90% confidence, ** 95%, *** 99%. Robust standard errors in parentheses. All regressions include Village Fixed Effects. Regressions (2) includes controls for farmer's raven score, years of education, gender, ability to read a newspaper, ability to write a letter, score for coffee best practices followed, whether or not the farmer agrees that drought is the most important risk that he/she faces, a score for whether the farmer is patient, number of coffee trees, whether the farmer can identify 60mm in a drawing.
The knowledge score is the sum of the number of correct answers to the following three questions: Imagine you have bought insurance against drought. If it rains less than 70mm by the end of November, you will receive a payout of 20KSh for every mm of deficient rainfall (that is, each mm of rainfall below 70mm). Will you paid out if (a) it rains 100mm? (b) It rains 60mm (If b = Yes) How much would you receive as a payout?

TABLE 6. **Outcomes from Follow-up**

Dependent variables	(1) "Insurance protects you in times of emergency"	(2) "Insurance companies try to cheat people even when they have a good claim"	(3) "I don't need insurance because my family, friends or relatives provide cover when necessary"
Comic in High Comic Intensity	0.057*	−0.223***	−0.092
	(0.029)	(0.063)	(0.061)
Comic in Low Comic Intensity	−0.009	−0.135	0.012
	(0.052)	(0.088)	(0.088)
No Comic in High Comic Intensity	0.075**	−0.319***	0.008
	(0.034)	(0.086)	(0.089)
No Comic in Low Comic Intensity	0.029	−0.216***	−0.098
	(0.033)	(0.063)	(0.062)
Voucher in High Voucher Intensity	−0.022	0.076	−0.309***
	(0.059)	(0.113)	(0.115)
Voucher in Low Voucher Intensity	0.038	0.028	−0.126
	(0.055)	(0.142)	(0.140)
Baseline Attitude	−0.023	0.014	0.026
	(0.023)	(0.056)	(0.080)
Observations	456	453	458
R-squared	0.06	0.072	0.06
Mean of Dependent Variable Among Controls	0.939	0.441	0.471
Village Fixed Effects	YES	YES	YES

Notes: Robust standard errors clustered at the village level, in parentheses.
* significant with 90% confidence, ** 95%, *** 99%.