



## **Crop Price Indemnified Loans for Farmers: A Pilot Experiment in Rural Ghana**

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# Crop Price Indemnified Loans for Farmers: A Pilot Experiment in Rural Ghana

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## Crop Price Indemnified Loans for Farmers: A Pilot Experiment in Rural Ghana

*Abstract:* Farmers face a particular set of risks that complicate the decision to borrow. We use a randomized experiment to investigate 1) the role of crop-price risk in reducing demand for credit among farmers and 2) how risk mitigation changes farmers' investment decisions. In rural Ghana, we offer farmers loans with an indemnity component that forgives 50% of the loan if crop-prices drop to a threshold price. A control group is offered a standard loan product. We find high loan uptake among all farmers and little significant impact of the indemnity component on uptake or other outcomes of interest.

*Key words:* agricultural credit, crop prices, crop price insurance, underinvestment, impact evaluation, clustered randomized control trial

Farmers face a particular set of risks that complicate the decision to borrow. Factors that are almost entirely unforeseeable and outside of their control, such as crop prices and weather patterns, have an enormous impact on farmers' fortunes – and on their ability to repay any loans they have taken. As such, some farmers are believed reluctant to take loans to finance seemingly profitable ideas for fear of not being able to repay. Paradoxically, from a bank's perspective, these may be excellent clients. They are so trustworthy that they are not borrowing out of fear of default. Can a loan product with a component that mitigates farmers' risk successfully encourage farmers to take, and benefit from, credit? What type of individuals are more likely to borrow when some of the risk is mitigated? And lastly but equally importantly, how does the mitigation of risk change farmers' investment decisions, such as the purchase of inputs?

Most of the theoretical literature on the impact of credit constraints on productivity focuses on supply side constraints. In a recent departure, Boucher, Carter and Guirkinger (2005) argue that in the presence of moral hazard, farmers will prefer not to borrow *even though the loan would raise their productivity and expected income*. Using panel data from Peru, they identify these “risk rationed” (as opposed to quantity rationed) households as households who never tried to access the formal market and show that risk rationing adversely affects the productivity of these households. Based on this they argue that improvements in the insurance offered to these households would increase their willingness to participate in formal credit markets and raise household welfare.

We conducted a simple social experiment. Mumuadu Rural Bank in the Eastern Region of Ghana, in conjunction with Innovations for Poverty Action, offered credit to farmers to invest in their farms. Mumuadu conducted marketing meetings to groups of

maize and garden egg (eggplant) farmers. Randomly assigned, in half of the meetings farmers were offered the opportunity to apply for loans that included crop price indemnification at no additional charge, i.e., if crop prices fell below a certain floor during the harvest time, their loan was forgiven. In the other half of the meetings (control), farmers were offered a normal loan, with repayment required irrespective of future crop prices. Farmers attending both sets of meetings merely knew that the bank was holding a meeting to talk about credit in their community; they were not told that there was variation in the types of loans being offered.

By conducting this as a randomized control trial, we address two general endogeneity problems. First, those who choose to participate in insurance programs are likely different than those who do not (e.g., more risk averse, perhaps more entrepreneurial or resourceful in finding good financial solutions to their problems), and second, those who are approved typically by lenders are different than those who are not. Note that although the take-up rates of the loans was 86% in the control and 92% in the treatment groups, our analysis of impacts is done on the intent to treat basis, i.e., everyone offered treatment loans are analyzed as part of the treatment group and the same for the control group.

We have three sources of data: a baseline survey, the administrative data from the bank with regard to take-up and repayment, and a follow-up survey that focused on investment decisions of the farmers.

Although we are unaware of crop price insurance offered to smallholder farmers, recent efforts to sell rainfall insurance are highly relevant. Gine and Yang (2009) study whether the inclusion of rainfall insurance (at marginal cost) into a loan product induces farmers to borrow. To their surprise, loan take-up was actually lower by 13 percentage

points among farmers that had to buy insurance along with the loan. They also find that take-up of the insured loan is positively correlated with education while take-up of the uninsured loan is not. Thus it is clear that inclusion of insurance in loans (in that case, at actuarially fair prices plus a load to cover insurance company costs) is not necessarily an easy task that generates higher demand for the loan.

## **II. Loan Product Description and Rationale**

Our choice of loan product was initially based on focus group meetings with farmers and Bank management. In these meetings, farmers reported that one reason they were not borrowing from Mumuadu Bank was fear of default in the event that prices collapse. Opinion from Bank management also suggested this was a significant risk. Several further factors made indemnification of crop prices a good candidate for the product. First, more than half of farmers interviewed in a baseline survey said they would be willing to pay to guarantee a floor for the price of their crop. Furthermore, rainfall, an alternative risk commonly discussed, does not vary enough in this region of Ghana to be considered a substantial risk for most farmers (Keyzer et al. 2007), but crop prices do vary considerably. Finally, crop prices are determined in centralized local markets and are thus outside any individual farmer's control or likely influence. Data on these prices are collected by government officials and are easily and quickly verifiable.

The Mumuadu Bank loan product was simple. If the price of the farmer's crop (either maize or garden egg) at the time of harvest fell below a given level (set to be at the 10<sup>th</sup> percentile of historical garden egg prices during harvest period and at the 7<sup>th</sup> percentile of historical year-long prices for maize), then Mumuadu Bank forgave 50% of

the principal and interest of the farmers' loan. To set the crop price levels and choose the crops, we gathered data from the Ghana Ministry of Agriculture and engaged in conversations with Ministry of Agriculture extension agents, farmers, and Mumuadu Rural Bank. We chose the two crops – garden eggs (eggplant) and maize – due to their prevalence in the region, their price volatility, and availability of historical data. Farmers attended the meetings already in groups designating them as either garden egg or maize, and there was no opportunity to switch crops afterwards depending on prices or other factors.

The loan with crop price indemnification aims to encourage investment, and thus the key outcome measure, beyond take-up of the loan, is whether investment behavior changed for the farmers.

### **III. Experimental Design**

The project launched in August 2007. Mumuadu Bank employees contacted key community members (district assemblyman, storekeepers, farmers) in each of five villages to collect the names of all maize and garden egg (eggplant) farmers in the village. From the listing, farmers were randomly assigned into either the control or treatment group, and the same community members invited the farmers to marketing meetings separated by treatment and control.

At the beginning of each of the marketing meetings, Mumuadu employees explained that the bank was doing marketing research on farmers in the area, and then asked the farmers to participate in a baseline survey. Table 1 presents the summary

statistics from this baseline survey for those who were also successfully reached in the follow-up survey, one year later. Appendix Table 1 presents the summary statistics from the baseline survey for everyone surveyed in the baseline, and compares those means to those also found for the follow-up, in order to assess whether there was any noticeable attrition pattern. The aggregate test finds that those who were found for the follow-up survey were systematically different (F-statistic = 1.82, p-value = 0.033). The attrition bias seems driven mostly by those who perceived price risk to be important, those who prefer to borrow from banks over relatives, and maize farmers (all three groups were more likely to be found for the follow-up survey).

Once the baseline survey was complete in the meetings, one of four credit officers from Mumuadu Bank then presented the loan offer to the group of farmers. A total of 169 farmers attended one of the 20 meetings. Of these 169, 91 were maize farmers and 78 were garden egg (eggplant) farmers. Farmers were not informed that the bank was offering two different products; rather, the bank simply offered the treatment group their loan offer, and offered the control group the loan without the crop price indemnification.

Farmers then had one month to apply for a loan. Loans were disbursed about one month after application; between September 13<sup>th</sup> and October 17<sup>th</sup> for maize farmers, and between November 17<sup>th</sup> and December 13<sup>th</sup> for garden egg farmers. Average loan size is 238 GHS (or 159 USD), which represents a large change in cash flow - roughly 13-38 percent of the typical farmer's average annual income. A follow-up survey was conducted after 2-3 crop cycles (roughly one year), to determine the impact of the indemnified loan on input usage and investment.

#### **IV. Data and Analysis**

The survey instrument for the pilot contains 28 questions and is primarily designed to measure basic demographic information plus data on loan history and plans, cognitive ability, risk perception and aversion, and financial management skills. The survey instrument is available upon request.

We begin with an analysis of differences in means. Our first goal is to verify that the randomization generated observably similar treatment and control groups. Table 1 Column 4 shows the t-statistics for a series of comparison of means, which all showed that the treatment assignment was orthogonal to all key observable variables collected in the baseline survey. The joint test of all covariates (F-stat = 0.93, p-value = 0.54 reported in the notes) also shows that the randomization successfully generated observable similar treatment and control groups jointly.

Next, we are interested in comparing the characteristics of those who apply for the standard loan to the characteristics of those who apply for the indemnified loan. For instance, are those who are more risk averse more likely to borrow with the indemnified loan? Or perhaps the price indemnification is difficult to understand, and thus those with higher cognitive abilities or education are more likely to take it up, relative to a simple loan. Ideally we would know the riskiness of different farmers (which perhaps is proxied by their risk aversion), in order to test a model of adverse selection versus advantageous selection.

Table 1 columns 5 through 13 show, via comparison of means, what types of individuals were more likely to take-up the loan overall (columns 5-7), under the control condition (columns 8-10), and the treatment condition (columns 11-13). Overall, farmers

who borrowed were roughly 6 years older than farmers who did not borrow, their cognitive scores were almost one full point higher, they were twice as likely to have borrowed previously, they had larger farms and spent more on chemical inputs.

Then Table 2 shows similar results using OLS and probit econometric specifications:

$$(1) \quad A_i = \gamma + \alpha T_i + X_i \beta + X_i T_i \delta_i + \varepsilon_i,$$

where  $A_i$  is either an indicator variable equal to 1 if the individual takes up a loan.  $T_i$  is an indicator variable for assignment to the treatment group – the farmers who get marketed the indemnified loan.  $X_i$  is a vector of demographic and other survey responses, and  $\varepsilon_i$  is an error term for farmer  $i$ , which allowed for clustering at the group (i.e., meeting) level.

We find very few differences in take-up. Any heterogeneity is likely masked by the large take-up rates for both: 86% in control group and 92% in treatment group (the difference is not statistically significant) took-up a loan. We do not find a difference in take-up due to cognitive score or prior experience borrowing, but we do find that those who believed that prices were likely to fall were *less* likely to take-up the treatment loan than the control loan.<sup>1</sup> This was significant at the 90% level. Our prior was the opposite: the loan protects farmers from prices falling, and thus those who believe prices will fall will have higher demand for crop price protection. The reversal of this we find interesting and puzzling. We posit one story, ex-post: the survey question picked up pessimism in

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<sup>1</sup> The question asked was, “In your view, what is the likelihood that the price of 27kg of garden eggs will fall below 70,000 between January and April?” Respondents could answer on a scale of 1 to 3 from very unlikely to very likely, and this is summed with the response to the same question asked about the next five years. A similar question was asked of maize farmers.

general, not just pessimism with respect to crop prices, and pessimistic individuals were skeptical of the indemnified loan product.

Next, in Table 3 (summary statistics and mean comparisons) and Table 4 (OLS and probit specifications), we estimate the impact of the indemnified loan on investment and profits using the first difference estimator obtained by comparing the levels of the outcome variables between the treatment and control groups.

Table 4 uses the following econometric specification:

$$(2) \quad Y_i = \alpha + \beta T_i + X_i \delta_i + \varepsilon_i,$$

where  $Y_i$  is the outcome of interest, and  $X_i$  is a vector of baseline covariates that are included in Column 1 and not included in Column 2. We use OLS for continuous variable and probit for binary variables. Appendix Table 2 shows the same results but using OLS (linear probability) for binary outcome variables as well. Due to the randomization, the first difference estimator provides an unbiased estimate of the impact of the indemnified loan on investment and profits, without risk of endogeneity with respect to who decided to take-up or who was offered credit by the bank.

We find that farmers offered the indemnified loans spent on average 17.9 percentage points (significant at 95%, but not significant when not including control variables) more on chemicals for their primary crop as a share of the total spent on chemical inputs. Other than this, there is no indication that the indemnified loan had an impact on investment in inputs. We also see a shift towards growing more garden eggs and less maize.

We also find a potentially interesting result regarding how and when farmers marketed their crop. Note that the indemnified loan was *not* conditional on the price that

they received for their crop, but rather on the average price in the area at the time of harvest. Farmers were 15% to 25% (depending on specification, and results only significant after including baseline covariates) more likely to sell their crops to market traders, rather than to farmgate sellers who come to them and pick up the crop. Anecdotal evidence suggests that the farmgate sellers offer contracts which lock in prices, but at lower prices. Those willing to risk market prices are typically rewarded on average. Two further pieces of information would have helped tell a complete story, but we do not have them. First, if this interpretation is correct, historical price data at the farmgate should be lower and less volatile than historical price data at the market. Second, we should be able to document that farmgate buyers are indeed locking in prices for farmers before harvest.

Lastly, default was significant, with 58% of borrowers (no difference between treatment and control) in default as of May 2009.

## **V. Discussion and Directions for Future Research**

Ironically, the surprisingly high take-up rate of credit made it difficult to assess heterogeneity in take-up that the study aimed to test. We specifically designed this product to be built-in to the loan, rather than as an add-on insurance. This, combined with the fact that the triggering event was measured by the Ministry of Agriculture, reduced the processing costs for the Bank. We also integrated the insurance with the loan to avoid choice overload problems (i.e., when too many choices cause stagnation in decision-making, see Bertrand et al. (2010) and Iyengar and Lepper (2000)). Gine and Yang (2009) also discuss this issue (and related issues of confusion that the insurance may generate to those unfamiliar with insurance) in working paper versions of their rainfall insurance experiment, in which take-up rates for credit plus rainfall insurance were lower

than take-up rates for credit alone (in their case, the rainfall insurance was priced at actuarially fair prices plus a load). How to ensure that farmers truly understand such a product is a larger question which can be explored through further empirical research.

Due to the high take-up rates and thus little room for heterogeneity in take-up, we focus our attention on the impact, or lack thereof in significant ways, on farmer decisions. A few factors may be at work to generate few impacts. First, did farmers fully understand the indemnity clause? Priced fairly, the product undoubtedly makes financial sense for many farmers; by investing more in their crops they are more likely to earn increased farm income, and this product lowered the risk they faced with such investments. Second, perhaps one year is simply not enough time. The farmers needed to believe that the crop price indemnification loans would be offered for years to come in order to start making large investment changes. Third, the high rates of default we observe may indicate that the bank already effectively had in place a flexible "loan forgiveness" program, so the additional indemnification had little impact on behavior. Lastly, it could be that the crop prices were simply not causing that much volatility for farmers. Observed crop prices may have been volatile, and may have been the focus of much attention, but through storage and optimal timing of sales farmers are able to mitigate this risk at least partially on their own. Lastly, sample size of the study was small, and thus many of the results were positive but not significant statistically. In many of the cases, we are not able to rule out large and meaningful results.

This experiment tried to address a key question for development: does risk inhibit investment. Although many interventions try to mitigate risk by selling insurance or loans at market prices, the even simpler question remains: if the risk were removed, without

any selection effects, how would behavior change? We tried to answer this through the simplest way possible: to give away the crop price indemnification rather than sell it (and thus only observe the intent to treat effect on those who want their crop price risk mitigated). We see this approach as enlightening, to in a sense know how high the bar can be for the impact of insurance on investment. Further research needs to be done on other risks (e.g., rainfall), with larger sample sizes, and perhaps with training and longer term commitments to maintain a presence in a market.

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**Table 1: Baseline Summary Statistics: Orthogonality Verification and Take-up Analysis**  
**Mean and Standard Errors**

	Randomization			Decision to Apply			Decision to Apply: Control			Decision to Apply: Treatment			
	Reached for Follow-up Survey (N=126)	Control (N=66)	Treatment (N=60)	T-stat (2)<(3)	No (N=14)	Yes (N=112)	T-stat (5)<(6)	No (N=9)	Yes (N=57)	T-stat (8)<(9)	No (N=5)	Yes (N=55)	T-stat (11)<(12)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>General:</i>													
Age	43.413 (1.138)	44.394 (1.552)	42.333 (1.677)	0.903	37.929 (3.563)	44.098 (1.191)	1.716 *	34.111 (2.831)	46.018 (1.646)	2.765 ***	44.800 (8.267)	42.109 (1.697)	0.440
Female	0.151 (0.032)	0.121 (0.040)	0.183 (0.050)	0.969	0.143 (0.097)	0.152 (0.034)	0.087	0.111 (0.111)	0.123 (0.044)	0.098	0.200 (0.200)	0.182 (0.052)	0.099
Number of dependents	5.992 (0.264)	6.348 (0.399)	5.600 (0.335)	1.422	4.929 (0.715)	6.125 (0.282)	1.431	4.778 (0.969)	6.596 (0.430)	1.582	5.200 (1.114)	5.636 (0.353)	0.358
Education score (0 = no schooling, 9 = highest)	4.135 (0.201)	4.045 (0.277)	4.233 (0.295)	0.464	4.143 (0.686)	4.134 (0.211)	0.014	4.333 (0.866)	4.000 (0.293)	0.411	3.800 (1.241)	4.273 (0.305)	0.439
Cognitive score (1 = lowest, 7 = highest)	4.643 (0.121)	4.500 (0.162)	4.800 (0.181)	1.240	3.929 (0.355)	4.732 (0.127)	2.114 **	3.889 (0.484)	4.596 (0.170)	1.514	4.000 (0.548)	4.873 (0.189)	1.344
Ambiguity aversion score (1 = not averse, 3 = very averse)	2.310 (0.070)	2.242 (0.101)	2.383 (0.095)	1.007	1.929 (0.322)	2.357 (0.067)	1.949 *	2.111 (0.423)	2.263 (0.099)	0.512	1.600 (0.510)	2.455 (0.089)	2.595 **
Has health insurance	0.532 (0.045)	0.485 (0.062)	0.583 (0.064)	1.103	0.500 (0.139)	0.536 (0.047)	0.251	0.333 (0.167)	0.509 (0.067)	0.971	0.800 (0.200)	0.564 (0.067)	1.018
<i>Lending History:</i>													
Has borrowed previously	0.595 (0.044)	0.591 (0.061)	0.600 (0.064)	0.103	0.357 (0.133)	0.625 (0.046)	1.938 *	0.444 (0.176)	0.614 (0.065)	0.954	0.200 (0.200)	0.636 (0.065)	1.934 *
Has borrowed from financial institution	0.325 (0.042)	0.273 (0.055)	0.383 (0.063)	1.322	0.071 (0.071)	0.357 (0.045)	2.174 **	0.111 (0.111)	0.298 (0.061)	1.166	0.000 (0.000)	0.418 (0.067)	1.864 *
Prefers to borrow from bank, not relative	0.841 (0.033)	0.848 (0.044)	0.833 (0.049)	0.231	0.929 (0.071)	0.830 (0.036)	0.944	0.889 (0.111)	0.842 (0.049)	0.359	1.000 (0.000)	0.818 (0.052)	1.036
Would use loan to buy farm inputs	0.952 (0.019)	0.924 (0.033)	0.983 (0.017)	1.558	1.000 (0.000)	0.946 (0.021)	0.883	1.000 (0.000)	0.912 (0.038)	0.916	1.000 (0.000)	0.982 (0.018)	0.299
<i>Farming:</i>													
Perceived likelihood of price falling (1=not likely, 6 = very likely)	2.548 (0.091)	2.576 (0.133)	2.517 (0.125)	0.322	2.429 (0.309)	2.563 (0.096)	0.460	2.000 (0.333)	2.667 (0.142)	1.744 *	3.200 (0.490)	2.455 (0.127)	1.678 *
Maize farmer (vs. garden egg farmer)	0.579 (0.044)	0.591 (0.061)	0.567 (0.065)	0.273	0.500 (0.139)	0.589 (0.047)	0.634	0.444 (0.176)	0.614 (0.065)	0.954	0.600 (0.245)	0.564 (0.067)	0.154
Number of crops planned	1.968 (0.082)	1.970 (0.120)	1.967 (0.111)	0.018	1.786 (0.334)	1.991 (0.083)	0.786	2.111 (0.484)	1.947 (0.119)	0.465	1.200 (0.200)	2.036 (0.116)	2.137 **
Planned to grow maize at baseline	0.643 (0.043)	0.682 (0.058)	0.600 (0.064)	0.953	0.643 (0.133)	0.643 (0.045)	0.000	0.667 (0.167)	0.684 (0.062)	0.103	0.600 (0.245)	0.600 (0.067)	0.000
Planned to grow gegg at baseline	0.452 (0.045)	0.424 (0.061)	0.483 (0.065)	0.661	0.500 (0.139)	0.446 (0.047)	0.377	0.556 (0.176)	0.404 (0.066)	0.849	0.400 (0.245)	0.491 (0.068)	0.383

Joint F-test of significance for selection into the treatment group: 0.93, p-value: 0.537

Standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

**Table 2: Analysis of Loan Take-up Decision**  
**Dependent variable: 1 = Borrowed; 0 = Did not Borrow**

	<b>OLS and Probit</b>			
	Probit	Probit	OLS	OLS
	(1)	(2)	(3)	(4)
Treatment (loan included price indemnification)	0.020	0.195	0.046	0.389
	(0.046)	(0.221)	(0.062)	(0.282)
Age	0.003	0.004	0.004	0.005
	(0.002)*	(0.002)**	(0.002)	(0.002)**
Female	0.031	0.036	0.015	0.037
	(0.040)	(0.024)	(0.053)	(0.051)
Cognitive score	0.045	0.035	0.055	0.063
(1 = lowest, 7 = highest)	(0.015)***	(0.017)**	(0.022)**	(0.033)*
Perceived likelihood of price falling	0.011	0.043	0.013	0.066
(1 = not likely, 6 = very likely)	(0.023)	(0.032)	(0.028)	(0.034)*
Has borrowed previously	0.121	0.04	0.115	0.058
	(0.072)*	(0.054)	(0.072)	(0.082)
Maize farmer (vs. garden egg farmer)	0.090	0.057	0.086	0.072
	(0.051)*	(0.039)	(0.053)	(0.058)
Cognitive score* treatment		0.007		-0.015
		(0.021)		(0.038)
Perceived likelihood of price falling * treatment		-0.088		-0.130*
		(0.045)*		(0.065)
Has borrowed previously * treatment		0.067		0.102
		(0.041)		(0.140)
Constant			0.282	0.105
			(0.218)	(0.235)
Observations	126	126	126	126
R-squared			0.12	0.17

Robust standard errors in parentheses.

\* significant at 10% \*\* significant at 5%; \*\*\* significant at 1%

**Table 3: Outcome Summary Statistics**  
**Mean and Standard Errors**

	Overall (N=126)	Control (N=66)	Treatment (N=60)	T-stat (2) <math>\hat{> (3)</math>
	(1)	(2)	(3)	(4)
<i>Borrowing:</i>				
Applied for loan	0.889 (0.028)	0.864 (0.043)	0.917 (0.036)	0.942
Loan principal (GHS)	-238.4 (6.24)	-239.6 (9.41)	-237.2 (8.26)	0.187
Had overdue balance in May 2009, borrowers only	0.582 (0.047)	0.571 (0.067)	0.593 (0.067)	0.223
Had overdue balance in May 2009, all obs	0.508 (0.045)	0.485 (0.062)	0.533 (0.065)	0.540
<i>Cultivation and Inputs:</i>				
Cultivated indemnity crop	0.802 (0.036)	0.758 (0.053)	0.850 (0.046)	1.298
Cultivated garden egg	0.254 (0.039)	0.182 (0.048)	0.333 (0.061)	1.966 *
Cultivated maize	0.738 (0.039)	0.773 (0.052)	0.700 (0.060)	0.923
Amount of land farmed in minor season (acres)	2.567 (0.139)	2.773 (0.190)	2.342 (0.201)	1.562
Amount of land farmed: indemnity crop (acres)	2.147 (0.207)	2.288 (0.338)	1.992 (0.229)	0.712
Used certified seed on indemnity crop, growers only	0.490 (0.051)	0.449 (0.072)	0.531 (0.072)	0.803
Used certified seed on indemnity crop, all obs	0.381 (0.043)	0.333 (0.058)	0.433 (0.065)	1.151
Total spent on chemicals for indemnity crop (GHS)	54.795 (6.546)	60.670 (11.451)	48.333 (5.513)	0.941
Total spent on chems for indemnity crop, % all crops	0.679 (0.040)	0.604 (0.058)	0.762 (0.054)	1.990 **
Total labor days used	36.722 (4.208)	33.833 (3.947)	39.900 (7.719)	0.719
Total labor days used on indemnity crop	27.016 (3.215)	26.138 (3.995)	28.000 (5.177)	0.288
<i>Income and Sales:</i>				
Amount harvested from garden egg crop (kg)	101.03 (37.23)	80.98 (31.53)	123.08 (70.34)	0.563
Amount harvested from maize crop (kg)	339.30 (46.23)	409.11 (73.64)	262.50 (52.39)	1.594
Revenue for all crops (GHS)	309.25 (41.45)	346.05 (65.04)	268.78 (49.66)	0.930
Sold indemnity crop	0.929 (0.026)	0.939 (0.035)	0.918 (0.040)	0.389
Sold indemnity crop to market trader, growers only	0.440 (0.052)	0.348 (0.071)	0.533 (0.075)	1.795 *
Sold indemnity crop to market trader, all obs	0.317 (0.042)	0.242 (0.053)	0.400 (0.064)	1.910 *

Standard errors in parentheses. \* significant at 10%, \*\* significant at 5%; \*\*\* significant at 1%.

"Indemnity crop" refers to maize for the maize group and garden eggs for the garden egg group.

**Table 4: Treatment Effects**  
**Dependent Variables: Each row represents a different dependent variable**  
**OLS and Probit**

	Without Controls	With Controls
	(1)	(2)
<i>Borrowing:</i>		
Applied for loan	0.053 (0.061)	0.030 (0.048)
Loan principal (GHS)	2.349 (25.58)	-0.916 (15.88)
Had overdue balance in May 2009, borrowers	0.021 (0.124)	0.041 (0.137)
Had overdue balance in May 2009, all obs	0.048 (0.122)	0.069 (0.124)
<i>Cultivation and Inputs:</i>		
Cultivated indemnity crop	0.092 (0.131)	0.102 (0.060)
Cultivated garden egg	0.152 (0.148)	0.175 ** (0.081)
Cultivated maize	-0.073 (0.147)	-0.070 (0.074)
Amount of land farmed in minor season (acres)	-0.431 (0.325)	-0.428 (0.345)
Amount of land farmed: indemnity crop (acres)	-0.296 (0.447)	-0.257 (0.388)
Used certified seed on indemnity crop, growers only	0.082 (0.111)	0.086 (0.118)
Used certified seed on indemnity crop, all obs	0.100 (0.103)	0.115 (0.091)
Total spent on chemicals for indemnity crop (GHS)	-12.34 (19.07)	-12.50 (18.37)
Total spent on chems for indemnity crop, % all crops	0.158 (0.157)	0.179 ** (0.080)
Total labor days used	6.067 (10.493)	4.990 (9.653)
Total labor days used on indemnity crop	1.862 (9.155)	1.456 (7.273)
<i>Income and Sales:</i>		
Amount harvested from garden egg crop (kg)	42.10 (112.12)	28.87 (92.36)
Amount harvested from maize crop (kg)	-146.61 * (72.85)	-147.45 * (74.97)
Revenue for all crops (GHS)	-77.27 (89.83)	-85.98 (70.74)
Sold indemnity crop	-0.020 (0.075)	-0.061 (0.102)
Sold indemnity crop to market trader, growers	0.186 (0.118)	0.254 (0.115) **
Sold indemnity crop to market trader, all obs	0.158 (0.111)	0.185 (0.103) *

Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. OLS specifications for all non-binary dependent variables, probit specifications for all binary variable dependent variables. Appendix Table 1 shows same table using OLS for all dependent variables. Control variables for column (2) are age, female, education, cognitive score, ambiguity aversion, perceived likelihood of price drop, and maize farmer (vs. garden egg group). "Indemnity crop" is maize for the maize farmer group and garden eggs for the garden egg group.

**Appendix Table 1: Analysis of Attrition**

	Full Sample Interviewed at Baseline (N=169)	Interviewed at Baseline Only (N=43)	Reached for Follow-up Survey (N=126)	T-stat (2)>(3)
	(1)	(2)	(3)	(4)
<i>General:</i>				
Age	42.905 (0.957)	41.419 (1.735)	43.413 (1.138)	0.908
Female	0.166 (0.029)	0.209 (0.063)	0.151 (0.032)	0.888
Number of dependents	5.840 (0.225)	5.395 (0.428)	5.992 (0.264)	1.156
Education score (0 = no schooling, 9 = highest)	4.254 (0.168)	4.605 (0.294)	4.135 (0.201)	1.219
Cognitive score (1 = lowest, 7 = highest)	4.609 (0.104)	4.512 (0.206)	4.643 (0.121)	0.547
Ambiguity aversion score (1 = not averse, 3 = very averse)	2.260 (0.062)	2.116 (0.130)	2.310 (0.070)	1.365
Has health insurance	0.538 (0.038)	0.558 (0.077)	0.532 (0.045)	0.298
<i>Lending History:</i>				
Has borrowed previously	0.592 (0.038)	0.581 (0.076)	0.595 (0.044)	0.159
Has borrowed from financial institution	0.325 (0.036)	0.326 (0.072)	0.325 (0.042)	0.002
Prefers to borrow from bank, not relative	0.811 (0.030)	0.721 (0.069)	0.841 (0.033)	1.745 *
Would use loan to buy farm inputs	0.964 (0.014)	1.000 (0.000)	0.952 (0.019)	1.458
<i>Farming:</i>				
Perceived likelihood of price falling (1=not likely, 6 = very likely)	2.414 (0.079)	2.023 (0.147)	2.548 (0.091)	2.941 ***
Maize farmer (vs. garden egg farmer)	0.538 (0.038)	0.419 (0.076)	0.579 (0.044)	1.833 *
Number of crops planned	2.030 (0.070)	2.209 (0.135)	1.968 (0.082)	1.496
Planned to grow maize at baseline	0.627 (0.037)	0.581 (0.076)	0.643 (0.043)	0.717
Planned to grow gegg at baseline	0.485 (0.039)	0.581 (0.076)	0.452 (0.045)	1.462

Joint F-test of significance on being surveyed at follow-up: 1.82, p-value: 0.033

\* significant at 10%, \*\* significant at 5%; \*\*\* significant at 1%.

**Appendix Table 2: Treatment Effects**  
**Dependent Variables: Each row represents a different dependent variable**

	OLS Only	
	Without Controls	With Controls
	(1)	(2)
<i>Borrowing:</i>		
Applied for loan	0.053 (0.061)	0.042 (0.062)
Loan principal (GHS)	2.349 (25.58)	-0.916 (15.88)
Had overdue balance in May 2009, borrowers	0.021 (0.124)	0.042 (0.138)
Had overdue balance in May 2009, all obs	0.048 (0.122)	0.068 (0.126)
<i>Cultivation and Inputs:</i>		
Cultivated indemnity crop	0.092 (0.131)	0.113 (0.072)
Cultivated garden egg	0.152 (0.148)	0.156 ** (0.071)
Cultivated maize	-0.073 (0.147)	-0.070 (0.077)
Amount of land farmed in minor season (acres)	-0.431 (0.325)	-0.428 (0.345)
Amount of land farmed: indemnity crop (acres)	-0.296 (0.447)	-0.257 (0.388)
Used certified seed on indemnity crop, growers	0.082 (0.111)	0.082 (0.117)
Used certified seed on indemnity crop, all obs	0.100 (0.103)	0.109 (0.090)
Total spent on chemicals for indemnity crop (GHS)	-12.34 (19.07)	-12.50 (18.37)
Total spent on chemicals for indemnity crop, % all crops	0.158 (0.157)	0.179 ** (0.080)
Total labor days used	6.067 (10.493)	4.990 (9.653)
Total labor days used on indemnity crop	1.862 (9.155)	1.456 (7.273)
Amount harvested from garden egg crop (kg)	42.10 (112.12)	28.87 (92.36)
Amount harvested from maize crop (kg)	-146.61 * (72.85)	-147.45 * (74.97)
<i>Sales and Income:</i>		
Revenue for all crops (GHS)	-77.27 (89.83)	-85.98 (70.74)
Sold indemnity crop	-0.020 (0.075)	-0.035 (0.079)
Sold indemnity crop to market trader, growers	0.186 (0.118)	0.250 * (0.121)
Sold indemnity crop to market trader, all obs	0.158 (0.111)	0.176 (0.106)

This table repeats Table 4 using OLS specification for all dependent variables. Robust standard errors in parentheses. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control variables for (2) are age, female, education, cognitive score, ambiguity aversion, perceived likelihood of price drop, and maize farmer (vs. garden egg group). "Indemnity crop" is maize for the maize farmer group and garden eggs for the garden egg group.