Does cost-sharing increase learning? Experimental evidence from seed trail packs in Uganda

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!data collection in progress!

Abstract

A popular supply side intervention to increase adoption of a particular technology is some level of subsidy. However, it is often argued that if something was subsidized (or even provided for free), it is not valued as much may is more likely to be used for the intended purpose. We test whether farmers use seed that was obtained for free differently than if they had to pay a (small) price for it. Furthermore, we use a two-stage pricing design that allows us to disentangle the selection effect, whereby farmers that are prepared to pay a price are likely to be more motivated to learn from it, from the sunk cost effect, where a product that has a price attached to it is valued more.

Keywords: technology adoption, subsidies, screening effect, sunk cost effect, demonstration.

JEL: Q16, H24, O33, D91

1 Motivation

A popular supply side intervention to introduce a new agricultural technology is some level of subsidy. Private sector actors such as seed companies or agro-input dealers often use trail packs, as they realize farmers may be reluctant to try out a new product. Public actors may think commercial seed are out of

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reach of poor households and want to kick-start large scale adoption by providing the initial investment. The case for free (or subsidized) inputs also stems from positive externalities: it is well established that one of the most effective ways to increase technology adoption is through peer learning, and both private and public partners may attempt to leverage social learning (Conley and Udry, 2010; Bandiera and Rasul, 2006). Furthermore, informal seed systems used by farmers often suffer from decades of seed degeneration due to recycling of seed introduced during colonial times (McGuire and Sperling, 2016). Injecting new seed varieties can be an important strategy to improve the overall seed stock in the informal sector. For instance, public research organizations often invest in open pollinating varieties (OPVs) that can be recycled to some extent without losing vigor.

At the same time, it is often argued that providing goods or services for free (or with a significant subsidy) distorts the utility people attach to it. As a result, the good or service remains unused, is resold, or otherwise used in unintended ways. High profile examples include the use of free bed-nets for fishing or the use of subsidized chlorine for cleaning (instead of drinking water treatment) (Cohen and Dupas, 2010; Ashraf, Berry, and Shapiro, 2010).

There are at least three ways in which charging a price may lead to increased usage. The first is a *screening effect*, whereby only people who really value the product will acquire the product (while those who do not intent to use it will be less likely to buy it). A second is more psychological in nature and conjectures that people are prone to *sunk cost effects*, and as a result, paying a positive price for something leads one to appreciate it more (regardless of whether you really want it or not). Finally, prices may also provide a *signal for quality*.

Kremer, Rao, and Schilbach (2019) note that learning about new technologies requires costly experimentation and costly attention, and so individuals would benefit from decreasing the costs of learning. The fact that learning is also costly means the same mechanisms (a screening effect and/or a sunk cost effect) may also affect the extent to which farmers learn. That is, if a seed is valued less because it is provided for free, it may also be that farmers put in less effort and complementary investment when experimenting, and pay less attention to outcomes. Examples include planting subsidized seed on suboptimal plots or mixing subsidized seed with farmer-saved seed, which would make learning harder.

The above also suggests that the size of the subsidy and the relative magnitude of screening and sunk cost effects are important unknowns when evaluating supply interventions to promote seed varietal turnover. In this study, we use an intervention that has three treatment arms. In one treatment arm, a seed trial pack is provided for free. In a second treatment arm, we offer farmers the opportunity to buy seed through a sequential bargaining game. In a third treatment arm a two stage pricing design is used, where we again play the sequential bargaining game to identify the screening effect, and then provide a discount to isolate the sunk cost effect.

This document was started as a dynamic report prior to data endline data collection. It combines latex with R code using the Knitr engine and is tracked under revision control on github. As such, this "mock report" will provide a useful reference in evaluating the final results of the study (Humphreys, Sanchez de la Sierra, and van der Windt, 2013; Duflo et al., Working Paper).

2 Methods and experimental design

To test whether farmers learn differently from seed that was obtained for free than if they had to pay a (small) price for it, we use a randomized two-stage pricing design to isolate the sunk-cost effect from the screening effect (Ashraf, Berry, and Shapiro, 2010; Cohen and Dupas, 2010). In the original designs, subjects are offered a service or good for a particular price in a first stage. In a second stage, a discount is applied to that price. Regressing outcomes (such as whether the product is used for the intended purpose) on the price while controlling for the discount gives an estimate of the screening effect of the price; regressing outcomes on the discount while controlling for the price gives an estimate of the sunk cost effect. We will use a slightly different design with three treatment arms, where one group gets seed for free, a second group gets to pay for the seed pack, and a third group gets to pay but gets a 100 percent surprise discount.

The two stage pricing design consist of a first stage where farmers are offered the opportunity to buy a bag of seed from the enumerator in a way that is as close as possible as how this happens in a real life setting where bargaining is the norm. The enumerator follows a standard script. An initial ask price is randomly drawn, ranging from 12,000 to 9,000, and this price is then presented to the farmer as the price of the bag of seed. The enumerator then explains what kind of seed it is and what the advantages are. The farmer has the option to accept this price or not. If the farmer does not accept the ask price, then the farmer is encouraged to name his/her first bid price.

A computer algorithm then determines a counter-offer that the enumerator asks in a second round of negotiation. This new ask price is determined as the farmer's bid price plus 80 percent of the difference between the (initial) ask price and the farmer's bid price, and this is rounded to the nearest multiple of 500. This updated (lower) ask price is then presented to the farmer and the farmer gets another opportunity to accept or not. If the farmer does not accept, he or she is encouraged to make a second bid and a third ask price is determined as the farmer's last bid price plus 80 percent of the difference between the last ask price and the farmer's last bid price. Bargaining continues until the farmer accepts an ask price, or the price difference between the bid and ask price is smaller than 500 ugandan shilling, in which case the computer instructs the enumerator sell at the last price the farmer bids. To make the bargaining also incentive compatible for the enumerators, we tell them in advance that the money that is collected from farmers during this first stage will be divided and distributed equally among all the enumerators.[1]

[1] A popular alternative way to measure willingness to pay is a Becker-DeGroot-Marschak (BDM) auction. In it simplest version, the subject formulates a bid and this bid is compared

The second stage of the design involves providing an unexpected discount on the price. Most pricing designs use a random discount to be included as a continuous variable in the regression, or a set of equally spaced discounts. The aim of this is often to set optimal subsidy level. In our study, we want to maximize power and work with only one discount. In particular, half of the farmers that bought seed will get all their money back (100 percent discount). The decision to use only a single full discount is also due to the fact that we expect a discontinuity in the relationship (free versus paying, even though it may be only a little) and the fact that we also want to maximize sample size for a comparison between the 100 % discount and the farmers that get the free seed trial pack.

Treatment assignment will be at the village level, as we want to avoid that a control farmer (that gets a bar of soap as a token of gratitude) lives right next to a treatment farmer that gets a bag of maize seed for free. We will work with 10 farmers per village, which is the maximum our field teams can handle.

3 Estimation and inference

We will estimate the following equation

$$Y_{ij} = \alpha + \beta_P T_{ij}^P + \beta_D T_{ij}^D + \varepsilon_{ij} \tag{1}$$

where $Y_i$is an outcome of interest for farmer *i*, T_i^P is an indicator that takes the value of one if the farmer paid a price for the seed (through the bargaining) and T_i^D indicator that takes the value of one if the farmer paid a price for the seed (through the bargaining) and also received a 100 percent discount.

Because we will test for treatment effects on a range of outcome measures, we will deal with multiple outcomes and multiple hypotheses testing by means of two approaches. Firstly, we follow a method proposed by Anderson (2008) and aggregate different outcome measures within each domain into single summary indices. Each index is computed as a weighted mean of the standardized values of the outcome variables. The weights of this efficient generalized least squares estimator are calculated to maximize the amount of information captured in the index by giving less weight to outcomes that are highly correlated with each other. Combining outcomes in indices is a common strategy to guard against over-rejection of the null hypothesis due to multiple inference. However, it may also be interesting to see the effect of the intervention on individual outcomes. An alternative strategy to deal with the multiple comparisons problem is to adjust the significance levels to control the Family Wise Error Rates (FWER). The simplest such method is the Bonferroni method. However, the Bonferroni adjustment assumes outcomes are independent, and so can be too conservative

to a price determined by a random number generator. If the subject's bid is greater than the price, they pay the price and receives the item being auctioned. If the subject's bid is lower than the price, they pay nothing and receive nothing. However, after testing in the field, we found that too many farmers had problems comprehending the procedure, struggling especially with the fact that they could not bargain over the price.

when outcomes are correlated. We therefore use a Bonferroni adjustment which adjusts for correlation (Sankoh, Huque, and Dubey, 1997; Aker et al., 2016)

4 Results

4.1 Baseline balance

Standard orthogonality tables will be included in the final paper. We pre-register 10 variables. Half of these are characteristics that are unlikely to be affected by the intervention, while the other 5 are picked from the primary and secondary endline outcomes listed in the next subsection. The following variables will be compared at baseline:

4.2 Outcomes

In this section, we provide tables for main outcome families that were pre-registered on simulated data. Outcomes are organized in 6 families. We look at effects on the use of the trial seed, on agronomic input use and recommended practices, on characteristics of the trail seed, on yields (overall and on the trial plot), and on adoption intentions for the next season. We also have a table that looks at some on two potential ways in which paying for seed may affect learning: attention and valuation.

5 Ethical clearance

This research received clearance form Makerere's School of Social Sciences Research Ethics Committee (MAKSSREC 01.23.627/PR1) as well as from IFPRI IRB (DSGD-23-0108). The research was also registered at the Ugandan National Commission for Science and Technology (SS1657ES).

6 Transparency and replicability

To maximize transparency and allow for replicabiliy, we use the following strategies:

- pre-analysis plan: in the past, a document was prepared that provides an ex-ante step-by-step plan setting out the hypothesis we will test, the intervention we will implement to test these hypotheses, the data that will be collected and specifications we will run to bring the hypotheses to the data. This pre-analysis plan was pre-registered at the AEA RCT registry.

- revision control: the entire project will be under revision control (that is time stamped track changes) and committed regularly to a public repository (github).

Table 1: Baseline Balance

	mean	selection	sunk cost	nobs
Age of household head - years	55.49	12.555	11.542	1149
	(84.31)	(11.622)	(9.038)	
Household head has finished primary education - 1 is yes	0.51	0.024	-0.006	1149
	(0.501)	(0.044)	(0.044)	
Gender of household head - 1 is male	0.808	0.011	-0.058^{+}	1149
	(0.395)	(0.031)	(0.033)	
Household size	8.072	0.465	-0.275	1149
	(3.81)	(0.336)	(0.349)	
Distance of homestead to nearest agro-input shop	42.426	-7.263	8.726	1149
	(191.599)	(18.715)	(19.715)	
Has used quality maize seed on any plot in last season	0.395	0.037	0.004	1149
	(0.489)	(0.042)	(0.045)	
Has used the promoted seed (bazooka) on a randomly chosen plot in the last season	0.087	-0.019	-0.029	1149
	(0.282)	(0.025)	(0.023)	
Formal seed source	0.277	0.07	0.077^{+}	1149
	(0.448)	(0.049)	(0.045)	
How often was the seed that was used on the randomly selected plot recycled?	0.208	0.008	-0.034	1149
	(0.406)	(0.033)	(0.033)	
Maize yields on a randomly chosen plot in last season	6.268	-0.036	0.142	1140
	(0.996)	(0.102)	(0.087)	

Note:

Table 2: Effects on Use of trial seed

	mean	selection	sunk cost	nobs
used trail pack as seed	0.982	-0.025+	0.006	1150
	(0.133)	(0.014)	(0.016)	
did not mix seed with other seed	0.949	-0.05+	0.004	1150
	(0.221)	(0.025)	(0.028)	
field layout improved next to local seed	0.425	-0.103*	0.02	1150
	(0.495)	(0.043)	(0.041)	
kept produce from improved separate from local during and post harvest	0.645	-0.059	0.115*	1150
	(0.479)	(0.05)	(0.05)	
Index	0	-0.174*	0.112	1150
	(0.678)	(0.07)	(0.072)	

Note:

Table 3: Effects on Inputs and Agronomic practices

	mean	selection	sunk cost *nobs*	
Followed recommended seed spacing and seed rate	0.082	0.022	0.011	1150
	(0.274)	(0.027)	(0.03)	
Used organic fertilizer	0.309	0.036	0.067	1150
	(0.463)	(0.051)	(0.052)	
Used inorganic fertilizer (dap or urea)	0.256	-0.054	0.004	1150
	(0.437)	(0.036)	(0.04)	
Used chemicals	0.292	-0.034	0.032	1150
	(0.455)	(0.043)	(0.045)	
Gap filling	0.197	-0.064+	0.042	1150
	(0.398)	(0.035)	(0.03)	
Number of times weeding	2.435	0.015	0.083	1112
	(0.69)	(0.067)	(0.064)	
Timely planting	0.666	-0.064	0.086	1088
	(0.472)	(0.053)	(0.053)	
Index	0.014	-0.045	0.09*	1087
	(0.387)	(0.038)	(0.041)	

Note:

Table 4: Effects on assessment of characteristics

	mean	selection	sunk cost	nobs
Seed had higher yields that expected	0.66	-0.056	0.075	1150
	(0.474)	(0.055)	(0.054)	
Seed was more drought tolerant than expected	0.529	-0.008	-0.064	1150
	(0.5)	(0.068)	(0.066)	
Seed more pest/disease resistant than expected	0.412	0.035	-0.047	1150
	(0.493)	(0.069)	(0.072)	
Seed germinated better than expected	0.806	-0.013	0.017	1150
	(0.396)	(0.042)	(0.042)	
In general, was happy with the seed	0.808	-0.016	0.012	1150
	(0.394)	(0.038)	(0.039)	
Index	0	-0.02	-0.002	1150
	(0.673)	(0.096)	(0.098)	

Note:

Table 5: Effects on yield

	mean	selection	sunk cost	nobs
overall area	3.702	0.307	7.748	1140
	(50.601)	(3.756)	(8.815)	
overall production	6.303	0.255^{+}	-0.005	1140
	(1.155)	(0.139)	(0.138)	
overall yield	6.466	0.053	0.07	1125
	(0.708)	(0.065)	(0.079)	
trial plot area	0.296	0.032	11.487	1055
	(0.198)	(0.023)	(9.171)	
trial plot production	5.268	0.3^{**}	-0.105	1048
	(0.949)	(0.075)	(0.073)	
trial plot yield	6.642	0.201^{*}	-0.035	1048
	(1.086)	(0.086)	(0.119)	
index	-0.017	0.107^{*}	-0.013	1038
	(0.371)	(0.044)	(0.044)	

Note:

Table 6: Effects on plans

	mean	selection	sunk cost	nobs
planning to use improved seed?	0.591	0.058	-0.043	1150
	(0.492)	(0.052)	(0.046)	
planning to use bazooka?	0.532	0.064	-0.029	1150
	(0.5)	(0.055)	(0.049)	
acre planned under new seed (acre)?	1.468	0.121	-0.153	705
	(1.078)	(0.147)	(0.153)	
already bought improved seed for next season?	0.084	-0.023	0.033	1150
	(0.278)	(0.026)	(0.024)	
index	0.355	-0.026	0.044	705
	(0.554)	(0.065)	(0.055)	

Note:

Table 7: Pathways

	mean	selection	sunk cost	nobs
Attention: remembers seed type correctly	0.701	0.068	-0.006	1150
	(0.459)	(0.043)	(0.038)	
Attention: remembers producer	0.015	0.038*	0.002	1150
	(0.123)	(0.014)	(0.02)	
Valuation: price in shop	1.0156606×10^4	449.25^+	-291.201	652
	(2119.678)	(253.199)	(235.623)	
Valuation: price bought	7249.153		2249.153	704
	(2367.847)		(1294.882)	
Index	0.355	-0.026	0.044	705
	(0.554)	(0.065)	(0.055)	

Note: price bought only on subset of farmers that paid positive price - not included in index.

- mock report: This document provides a pre-registered report that was added to the AEA RCT registry and GitHub. This report differs from the pre-analyisis plan in that it already has the tables filled with simulated data. The idea is that after the endline, only minimal changes are necessary (basically connecting a different dataset) to obtain the final result, further reducing the opportunity of specification search. In the near future as data comes in, this report will be updated on github.

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