Comments on "The (perceived) quality of agricultural technology and its adoption: Experimental evidence from Uganda"

This paper is concerned about the low adoption of improved maize seeds sold by agro-dealers. The authors argue that low adoption could be due to agro-dealers not knowing how to store or handle the seeds, or to mis-perceptions by farmers, thinking that the seeds are of lower quality than in reality. The authors design two interventions to test these two hypotheses: a training of agro-dealers and a rating system about the quality of each agro-dealer disseminated to participating farmers. They find that the training had no effect but that the rating system led to higher take-up of seeds, especially among farmers that were not using improved seeds at baseline.

The paper covers an important topic, but I feel like the treatments could be better motivated, and that sharper tests should be provided for the various mechanisms that could drive the results. In what follows I try to provide suggestions of issues that should be clarified to rule out some pathways.

Agro-dealer handling and storing of seeds

The paper suggests that agro-dealers are unable to properly store or handle the seeds due to a combination of lack of knowledge and/or poor storage facilities. This claim should be backed by clear evidence. While 65% of agro-dealers had pests and 16% had opened bags in the storage facility, the paper also reports that the amount of maize seed lost/wasted is only a small share of the amount of maize seed sold. There might be under-reporting but agro-dealers, but wastage does not seem to be an issue, prima facie.

Of course, farmers could still be purchasing damaged seeds that will not germinate. To their credit, the authors proceed to purchase one bag of seeds from each agro-dealer and check for its moisture content, finding that the average moisture was higher than the recommended one. We do not know, however, the share of bags above the moisture threshold nor the probability that a bag of seeds with excess moisture will not germinate properly if planted. Related, moisture should presumably be more of an issue for *repackaged* seeds, that is, seeds sold in smaller bags repackaged by the agro-dealer from the original one manufactured by the seed provider. The paper should be clear about the share of agro-dealers that repackage seeds, whether the seeds purchased at random came from a repackaged bag, and finally, the share of farmers that actually purchase repackaged seeds.

Finally, and perhaps more importantly, one reason why the agro-dealer training was ineffective is that agro-dealers were already knowledgeable about how to store and handle seeds. To check that, Table 11 should report the raw score for the different questions that make up the index, since in the current version, both indexes are standardized, and one cannot assess actual knowledge.

Mechanisms

The paper correctly outlines the multiple pathways through which the ratings system could have an effect on purchases of improved seeds. First, the treatment may correct (mis)perceptions about seed quality that farmers have at baseline. Second, the treatment provides information about who the high-quality agro-dealers are, and so treated farmers switch to these agro-dealers after receiving the ratings. Finally, the ratings may increase the average quality by fostering competition across agro-dealers.

The paper tries to provide evidence to distinguish between these different mechanisms, but it should provide additional context and information.

Farmer mis-perceptions

To assess if initial mis-perceptions are driving the results, the paper should clarify if, given differences in clime, soil and cultivation practices of the farmer, there is an "optimal" seed variety. (As an aside, in a footnote or appendix the paper should also provide details about the pros and cons of hybrid seeds relative to OPV seeds, and between different varieties of hybrid seeds -Longe7H vs Longe 10H- and OPV seeds -Longe 4vs Longe 5).

If an optimal variety does exists for each farmer, are they aware of it? To address this, the paper should provide farmers' baseline knowledge about the quality of different seed varieties and the suitability of each to their plots. Do they know, for example, the average yield of each seed variety in their plots given normal weather conditions?

Related, the paper reports that 2/3 of farmers think that seeds from the agro-dealer are counterfeit or adulterated and use it as evidence of mis-perceptions about seed quality, particularly among farmers that did not purchase improved seeds. It is unclear, however, whether this question asked about seeds in general sold by the agro-dealer or about arguably the more relevant seed variety that the farmer purchased (or would likely purchase if they did not purchase improved seeds). To be clear, perceptions of seed quality should depend on the seed variety used, how they are packaged, the reputation of the seed provider (manufacturer brand) and the reputation of the agro-dealer. For example, if repackaged seeds are of lower quality because of agro-dealer mishandling, a farmer that never purchased repackaged seeds would have different perceptions about seed quality used than a farmer that only purchases repackages seeds.

Since agro-dealers appear to stock up different seed varieties (according to Table 6, the mean is 2.8), and presumably some have better protection against droughts, pests and diseases, but are likely more expensive, the single rating given per agro-dealer, will likely mask differences in the type of seeds sold by the agrodealer with differences in the quality of the storage facilities. In addition, some farmers might be willing to trade-off lower quality for a lower price, and yet pricing is not reflected in the ratings. Finally, ratings are also silent about how seeds were actually sold, whether in the original packages as sold by the manufacturer, or in smaller bags repackaged by the agro-dealer.

In short, the authors should explain why they decided to use a "generic" ratings system (one rating per agro-dealer), instead of an alternative one that was explicit about the seed variety and how it was sold (i.e. Longe 10H manufactured by X sold by agro-dealer Y in the original package).

Agro-dealer quality

To assess if the ratings system identified the agro-dealers of high quality, the paper should clarify the relationship between farmers and agro-dealers. We are told that there are between one and three agro-dealers in each of the study's catchment areas. With multiple agro-dealers, do farmers purchase seeds from the *same* agro-dealer every year? Since farmers could tell their peers that the seeds sold by their agro-dealer were of poor quality, it seems like reputational effects could play a role in this context. And if so, is it the reputation of the agro-dealer that matters, or that of the manufacturer of the seeds?

Related, seed characteristics such as germination time, yield, resistance against droughts, pests and diseases and duration relate to the quality of the product made by the manufacturer, so long as the maize is properly stored. In this sense, knowing that a given agro-dealer carries seeds from a particular manufacturer, and that seeds have not been repackaged should be enough to convince farmers of the quality of the seeds.

More broadly, the paper should report how well farmers knew the number of agro-dealers operating in their catchment area and their quality at baseline. Since knowledgeable treated farmers should not switch agro-dealers, the degree to which farmers are knowledgeable at baseline, can inform the likelihood of switching. In addition, it should make the result that the increase in the number of clients and in the usage of improved seeds is the result of the ratings (and not of the dissemination telling farmers about the existence of agro-dealers) more credible.

As an aside, I'd be curious to learn whether treated farmers were more accurate about the quality of agro-dealers over time and in general whether there was a lot of intra-market differences in quality.

Competition

The authors see an increase in registrations of treated agro-dealers with UNADA (the association of agro-dealers, as well as a significant increase in inspections. Do farmers value that agro-dealers are registered with UNADA? Do they know which agro-dealer is registered and who is not? Do they rate agro-dealers that are registered higher? Finally, did the ratings system lead to the opening of new agro-dealers in the catchment area?

Differential attrition

The authors report differential attrition, perhaps due to a larger share of control agro-dealers going out of business and then go on to conjecture that the unadjusted estimates likely provide lower bounds because the attritors are likely the ones that would have benefited the most from the treatment. I have two comments on this issue. First, the authors should check this claim using existing data. How do the characteristics of attritors in the control group compare to treated agro-dealers that benefit the most from treatment? And to those of treated agro-dealers that benefit the least?

Second, the literature suggests different methods to deal with differential attrition. One is to construct bounds following Lee (2009).

Other Comments

1. Table 4 should also report the number of maize varieties in stock, since this outcome variable appears in Table 6.
2. A rough back of the envelope calculation from Tables 6-8 suggests that 56% of revenues come from sales of Longe 10H while 41% from Longe 5 leaving the remaining 3% of revenues from the sale of the other two varieties… Is this true?
3. Table 6-8 could be run as a pooled regression, adding a dummy for whether data was collected at endline, as well as interactions with the treatment dummies. The midline and endline coefficients from this pooled regression could still be reported separately, but standard errors should be smaller given the larger number of observations in the pooled regression.

4. Related, when reporting the treatment effects on individual variables, the authors should also include the standard errors computed using multiple hypothesis testing corrections (see for example List et al. 2019).
5. Table 12 suggests that agro-dealers put more effort as they become more aware of the rating system. However, the ratings system only increases agro-dealer effort and services at midline and not at endline. Why? Should not the impacts be amplified over time? Or are agro-dealers able to make all the improvements by midline?
6. The paper states that rating system led to an increase in the number of customers. Is this increase fully accounted for by study participants or did it come from other individuals outside the experiment? Put differently, were ratings shared among farmers in treated catchment areas?
7. It would be interesting to check if treated farmers were less likely to buy repackaged bags, (ie smaller quantities of seeds from opened bags)
8. Feel free to ignore this comment, but I'm not a fan of the label clearinghouse for the ratings treatment, in part because clearinghouse refers to an institution that collects and disseminates information. The paper collects ratings and sends SMS with those ratings to participating farmers, but it does not create an institution or mechanism that can continue beyond the duration of the study. I would simply refer to the treatment as "ratings".
9. There are several typos throughout the paper so it would benefit from a review by a copy editor.

<u>References</u>

Lee, D. S. 2009. Training, wages, and sample selection: Estimating sharp bounds on treatment effects. *Review of Economic Studies* 76: 1071–1102.

List, J.A., Shaikh, A.M. & Xu, Y. 2019. Multiple hypothesis testing in experimental economics. *Experimental Economics* 22: 773–793.