Selected Poster/Paper prepared for presentation at the Agricultural & Applied Economics Association's 2017 AAEA Annual Meeting, Chicago, Illinois, July 30-August 1, 2017

Impact of access to livestock services on technical efficiency of small-ruminant production in rural Ethiopia

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Introduction

There are limited or no rural services in small ruminant markets of Ethiopia.

What do we know about the effect of the availability or lack thereof these services on technical efficiency of livestock production? Virtually nothing!!

Our objective

- To empirically show whether access to one or more of key livestock services on the technical efficiency of small ruminant production.
  - The services considered are agricultural extension on sheep and goat, rural credit for sheep and goat, and sheep and goat market information.

Sampling and study sites

Region	District	Value Chains	Sample
Highland			
Tigray	Atsbi	Sheep 1	162
SNNP	Doyogena	Sheep 2	152
Amhara	Menz (Mama & Gera)	Sheep 3	155
Oromia	Horro Gudru	Sheep 4	157
Amhara & Tigray	Abergelle	Goat 1	160
Lowland			
Oromia	Yabello	Goat 2	159
Somali	Shinelle	Goat/Sheep	162
Total Sample			**1107**

Analytical framework- 1. Efficiency analysis (SF Model)

$$y_i = \alpha + x_i'\beta + \varepsilon_i, \quad i = 2,...,N$$

$$\varepsilon_i = v_i - u_i \quad v_i \sim N(0,\sigma_v^2) \quad u_i \sim F$$

y_i is log of total gross revenue from shoats
x_i vector of (log of) inputs
ε_i composite error
v_i idiosyncratic error
u_i inefficiency (one-side disturbance)
F we employed exponential and truncated normal distributions.
Efficiency computed using Jondrow et al (1982): $E= exp(-E(s.u|\varepsilon)$ and Battese and Coelli (1988): $E= E[exp(-s.u|\varepsilon)]$ procedures. Four SFA (2 distributions x 2 efficiency measures) models estimated.

2. Multivalued treatment effects modelling (MVTM)

- ATE - the average effect of giving each individual treatment t instead of treatment 0:

$$ATE_t = E(y_t - y_0)$$

- POM - the POM for each treatment level is an average of each potential outcome:

$$POM_t = E(y_t)$$

- ATET - the average effect among those subjects that receive treatment level $\hat{t}$ of giving each subject treatment $\tilde{t}$ instead of treatment 0:

$$ATET_{\tilde{t},\hat{t}} = E\{(y_{\tilde{t}} - y_0)|t=\hat{t}\}$$

- MVTM requires three different trt levels: $\tilde{t}$ denotes the trt level of the potential outcome; 0 is the trt level of the control potential outcome; and $t=\hat{t}$ restricts the expectation to include only those individuals who actually receive trt level $\hat{t}$.

Adjustment and weighting procedures employed:

- Regression adjustment (RA).
- Inverse probability weighting (IPW).
- Augmented inverse probability weighting (AIPW)
- Inverse probability weighting with regression adjustment (IPWRA).

Results

Technical efficiency estimates of households given their access to services

Trt .	Services	Distr. of efficiency term	Mean	Min	Max
0	No service	Normal/Truncated normal	0.72	0.16	0.88
		Exponential	0.72	0.16	0.88
1	Agri. extension	Normal/Truncated normal	0.71	0.34	0.89
		Exponential	0.71	0.34	0.89
2	Market info on s	Normal/Truncated normal	0.70	0.38	0.86
		Exponential	0.70	0.38	0.86
3	Credit for shoat	Normal/Truncated normal	0.71	0.47	0.84
		Exponential	0.72	0.47	0.84
4	Extension and mkt info	Normal/Truncated normal	0.71	0.02	0.86
		Exponential	0.71	0.02	0.86
5	Extension and credit	Normal/Truncated normal	0.71	0.52	0.86
		Exponential	0.71	0.52	0.86
6	Mkt info and credit	Normal/Truncated normal	0.72	0.57	0.81
		Exponential	0.72	0.57	0.81
7	All services	Normal/Truncated normal	0.70	0.27	0.81
		Exponential	0.71	0.27	0.81
	Total	Normal/Truncated normal	0.71	0.02	0.89
		Exponential	0.71	0.02	0.89

Any effects on technical efficiency? Here is ATE....

	RA		IPW		AIPW		IPWRA	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust St. Err.
Extension on shoat only vs No service	0.010	0.009	0.001	0.007	0.010	0.006	0.009	0.006
Market info on shoat only vs No service	-0.015	0.013	0.010	0.008	-0.007	0.010	-0.009	0.010
Credit for shoat only vs No service	0.002	0.011	-0.014*	0.008	0.002	0.009	0.002	0.008
Extension and mkt info vs No service	-0.003	0.009	-0.003	0.007	-0.001	0.007	-0.003	0.007
Extension and credit vs No service	-0.004	0.013	-0.016	0.013	0.003	0.009	0.001	0.009
Mkt info and credit vs No service	0.018	0.024	-0.010	0.027	-0.011	0.033	0.000	0.021
All services vs No service	-0.020*	0.012	-0.018	0.011	-0.005	0.009	-0.008	0.009
Mean Potential Outcome								
Services (No service)	0.730‡	0.006	0.715‡	0.004	0.709‡	0.005	0.726‡	0.005

Here is ATET

	RA		IPW		IPWRA	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Extension on shoat only vs No service	0.011	0.009	0.001	0.007	0.015+	0.007
Market info on shoat only vs No service	-0.014	0.013	0.002	0.008	-0.008	0.010
Credit for shoat only vs No service	0.003	0.010	-0.014	0.009	0.007	0.010
Extension and mkt info vs No service	-0.002	0.008	-0.003	0.007	0.006	0.007
Extension and credit vs No service	-0.003	0.013	-0.018	0.013	0.001	0.009
Mkt info and credit vs No service	0.018	0.025	-0.010	0.029	-0.003	0.022
All services vs No service	-0.020*	0.012	-0.022*	0.012	0.004	0.009
Mean Potential Outcome						
Services (No service)	0.738‡	0.008	0.710‡	0.005	0.715‡	0.005

Conclusion and further questions

We could not see any relationship between and technical efficiency of sheep and goat production and access to the three key services; i.e, Agricultural extension on sheep and goat, Rural credit for sheep and goat, and Market information on sheep and goat in the sample.

- Notwithstanding the possible measurement errors both in inputs and outputs, it is important to ask at least three questions:

  Are the services properly designed?
  Are they being delivered the right way?
  Are the technologies provided to farmers through these services properly designed and targeted?