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INNOVATION LAB FOR FOOD SECURITY POLICY

Impacts of Improved Sorghum Varieties on Farm Families in Mali: A Multivalued Treatment Effects Approach

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Motivation

- Sorghum is a major food staple
- Investment in sorghum improvement since 1970s
- Low adoption rates (10-30%)
- Achieving yield gains difficult
- First sorghum hybrids could change the situation

Hypotheses

Working hypotheses	Test
I: Mechanism of improved varieties diffusion may not be well-adapted	Examine factors influencing adoption
II: Improved varieties may not be superior to local varieties	Measure impacts on farm families, including consumption and yields

Data

- 58 villages in the Sudanian Savanna of Mali
- 10 farm families randomly selected per village
- + 48 farm families growing sorghum hybrids
- 628 households, 723 sorghum plots
- 4 survey rounds 2014-15

Empirical strategy

Ordered logit

- Plot-level variety choice
- Differentiates:
  - 0 = local varieties
  - 1 = improved varieties
  - 2 = hybrids

Multivalued treatment

- Cattaneo (2010)
- Addresses selection bias
- ATE and percent of ATE
- 3 models for robustness

Empirical strategy

Notation

- t = {local (0) improved (1) hybrid (2)} is treatment type
- y_{1i} potential outcomes of adoption
- y_{0i} potential outcomes of non-adoption
- d_i denotes adoption status
- i= {1, . . ., n} is unit indexed

- **Outcome model**
- $y_i(t) = d_i(t)y_{1i}(t) + (1 -$

Empirical strategy

Model	Profile
1. Regression adjustment	models the outcome variable as a function of observables
2. Augmented, inverse-probability weighted (AIPW)	models both the outcomes and adoption as function of observables
3. Inverse-probability weighted, regression adjustment (IPWRA)	models both the outcomes and adoption as function of observables

Outcomes

- Yield
- Household Dietary Diversity Score (HDDS) (freq)
- Share of sorghum harvest sold

Results: Ordered Logit

	Improvement status	Robust Std. Err
individually-managed	-0.573*	(0.327)
wife	0.882**	(0.344)
son	0.407*	(0.240)
education	0.878***	(0.204)
location	0.00207	(0.00363)
erosion control	-0.475**	(0.204)
assets	0.206***	(0.0785)
labor supply	0.191**	(0.0826)
cooperative	-0.0147	(0.353)
market	-0.154	(0.197)
Constant cut1	3.605***	(1.143)
Constant cut2	6.049***	(1.148)
Observations	728	

Results: Multivalued treatment

		RA	AIPW MNL	IPWRA MNL
yield	improved	.3357052	.2275826	.3486967
	hybrid	.7880124**	1.025119**	1.8005***
freqhdds	improved	.0369894	-.0077307	-.0073753
	hybrid	.1150511	.0710718**	.0762431**
sharesold	improved	.937192**	1.242769**	1.166684**
	hybrid	2.556126***	1.601737**	1.614431**

Conclusions

- adoption determinants differ between collectively-and individually-managed plots
- plot manager characteristics are key determinants of adoption, in addition to household wealth and labor supply
- adopting new, guinea-race sorghum hybrids is associated with
  - superior yields
  - more diverse diet
  - a higher share of sorghum sold

Policy Implications

To encourage more widespread use of promising hybrids, attention will need to be paid to integrated seed systems, affordability, and a mechanism of diffusion for improved seed to incorporate not only the household head but also all economically active members of the EAF.

Future Research

- Further calibration of these results with detailed soils data in the yield outcome model
- Enhanced measures of dietary diversity in the consumption model