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Gender, Generation, and Agricultural Intensification: A Case of Two Cereals in the Sudanian Savanna of Mali

Veronique Theriault, Melinda Smale, Alpha Kergna, Amidou Assima, and Naman Keita

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MICHIGAN STATE UNIVERSITY

Motivation

Low yield growth for dryland cereals + rapid population growth-> Intensification is a priority

Roles and incentives are evolving

- Maize as a cash and food crop
- Youth seek more independence and autonomy in decision-making
- Women grow non-traditional crops on their individual plots

Better understanding the gender and generation dimensions on cereal intensification within complex farm households

Previous Work

Gender and generational hierarchy often determine access to labor and other productive resources
(Abeles and Collard, 1985)

Land scarcity contributes to the individualization of plot management
(Guirkinger and Platteau, 2014)

Higher yields on individual plots for maize but not for sorghum
(Guirkinger et al., 2015)

Objective

To examine whether adoption probabilities and intensity of fertilizer use differ by

- Plot management
- Gender
- Generation
- Crops

Data

Farm Household Survey

- Sudanian Savanna region of Mali
- Crop year 2014/2015
- Over 600 sorghum-growing households
- ~1300 maize and sorghum plots out of 4609 plots

Empirical Model and Strategy

$Zij^{*}=f(r, pij, plij, hj, Icij, Imij)$

Z: observed amount of fertilizer applied per hectare to a plot i cultivated by household j*

r: market characteristics (e.g., market fair, coop membership)

p: plot manager characteristics (e.g., gender, age, status, education)

pl: plot characteristics (e.g., SWC, distance)

h: household endowments (e.g., TLU, assets, cotton, active adults)

i: indicator variables for crops and type management

Cragg Model – allows the regression parameters to differ between the decision to use (1/0) and intensity of use (>0)

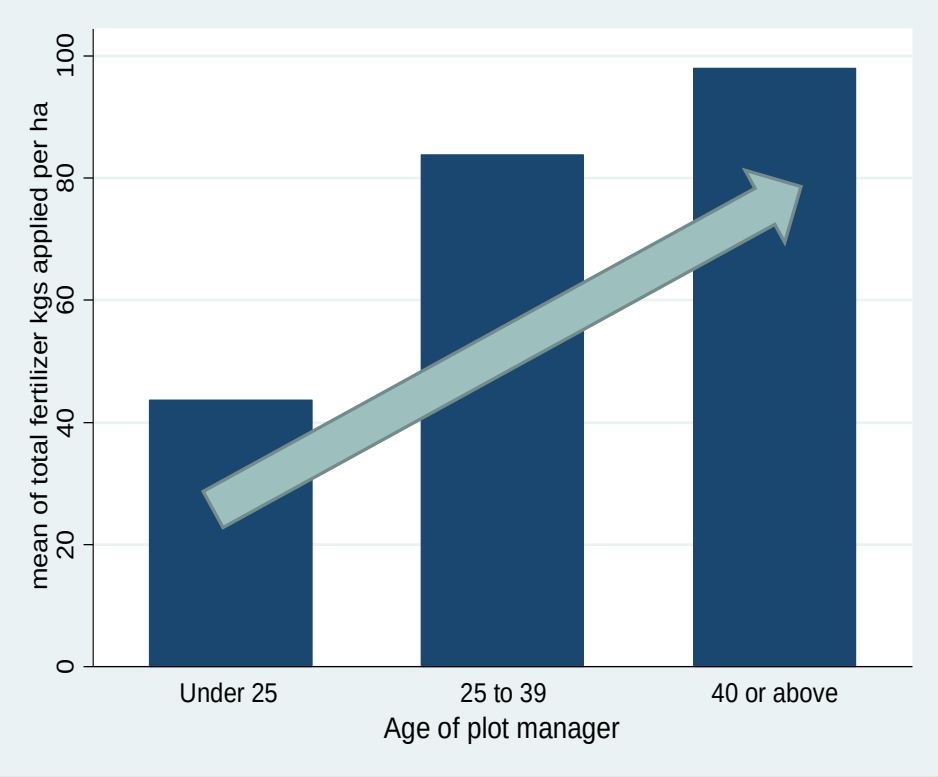
Descriptive Analysis

Table 1. Fertilizer use by plot management type

	Collective	Individual	Individual, male	Individual, female	p-value, 1 v 2	p-value, 3 v 4
	(1)	(2)	(3)	(4)		
% fertilized	57.8	45.7	43.8	45.8	0.001	0.872
unconditional, total kgs	154	27.3	51.1	25.4	0.000	0.045
unconditional, kgs/ha	104	38.7	29.2	39.5	0.000	0.505
conditional, kgs/ha	180	84.7	66.7	86.1	0.000	0.425
conditional, kgs/ha, sorghum plots	82.3	85.2	69.1	86.1	0.772	0.552

Descriptive Analysis

Figure 1 /Table 2. Fertilizer use on sorghum plots by age and status



	Mean	n
Head	23.1	380
First wife	39.4	109
Second wife	49.5	48
Son	17.8	80
Father	38.2	3
Brother	31.9	79
Daughter-in-law	26.0	35
All	27.8	734

Descriptive Analysis

Table 3. Fertilizer use by crop

	Maize	Sorghum	Test	p-value
% fertilized	84.6	33.5	Pearson chi	0.000
unconditional, total kgs	268	30.6	difference of means, t	0.000
unconditional, kgs/ha	177	27.8	difference of means, t	0.000
conditional, kgs/ha	211	83.4	difference of means, t	0.000

Cragg Model Results

Table 4. Fertilizer use by plot management

	Both crops		Maize		Sorghum	
	Use (0,1)	Kgs/ha (>0)	Use (0,1)	Kgs/ha (>0)	Use (0,1)	Kgs/ha (>0)
Individually-managed	0.489***	0.181**	-1.427**	-1.419***	0.469***	0.182
	(0.110)	(0.085)	(0.591)	(0.375)	(0.115)	(0.113)
Maize plot	1.597***	1.139***				
	(0.088)	(0.058)				
….	….	….	….	….	….	….
Observations	1,301	1,301	570	570	731	731

…. : Controlling for other covariates

Cragg Model Results

Table 5. Fertilizer use by plot management and gender

	Both crops		Maize		Sorghum	
	Use (0,1)	Kgs/ha (>0)	Use (0,1)	Kgs/ha (>0)	Use (0,1)	Kgs/ha (>0)
Individually-managed, female	0.542***	0.257***			0.464***	0.206*
	(0.113)	(0.086)			(0.117)	(0.114)
Individually-managed, male	-0.0678	-0.669***	-1.427**	-1.419***	0.569	-0.275
	(0.327)	(0.242)	(0.591)	(0.375)	(0.406)	(0.356)
Maize plot	1.612***	1.153***				
	(0.0888)	(0.0582)				
….	….	….	….	….	….	….
Observations	1,301	1,301	570	570	731	731

…. : Controlling for other covariates

Cragg Model Results

Table 6. Fertilizer use by generation

	Both crops		Maize		Sorghum	
	Use (0,1)	Kgs/ha (>0)	Use (0,1)	Kgs/ha (>0)	Use (0,1)	Kgs/ha (>0)
Youth	0.0218	-0.344**	-0.233	-0.444**	0.186	-0.381
	(0.225)	(0.161)	(0.432)	(0.215)	(0.262)	(0.253)
Wife	0.516***	0.285***			0.457***	0.168
	(0.121)	(0.0906)			(0.126)	(0.117)
Son	0.00530	-0.115	-0.205	-0.0196	0.141	-0.350**
	(0.124)	(0.0749)	(0.205)	(0.0765)	(0.160)	(0.162)
Maize plot	1.579***	1.145***				
	(0.0874)	(0.0564)				
….	….	….	….	….	….	….
Observations	1,301	1,301	570	570	731	731

…. : Controlling for other covariates

Conclusions

Adoption probabilities and intensity of fertilizer use DO differ by:

- Plot management type
- Gender
- Generation
- Crops

Controlling for other factors, we found that fertilizer use rates are:

- Higher on individual cereal plots than collective cereal plots
- Higher on individual sorghum plots managed by women, especially by the wives of the head, compared to collective sorghum plots
- Lower on individual maize plots compared to collective maize plots
- Lower on individual cereal plots managed by youth and sons of the head

Policy Implications

Agricultural policies influence fertilizer use

- Subsidized fertilizer are provided to the head only
- All maize hectares are eligible but not all sorghum hectares

Improving access to fertilizer by increasing women and youth participation

- Formal farmer cooperatives
- Existing programs (e.g., subsidy program)
- Extension services

Thank you