

Capturing the Missing Middle: Comparing Zambia's Emergent & Smallholder Farmers

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Motivation: On Farm Size and Productivity & Sources

- The negative relationship
 - ▶ Labor market imperfections (Chayanov 1926; Bardhan 1973; Feder 1985; Deininger et al. 2016)
 - ▶ Imperfections in land and insurance markets (Barrett 1996)
 - ▶ Credit market imperfections (Eswaran and Kotwal 1986; Barrett 1996)
 - ▶ Farmers' skills (Assuncao and Ghatak 2003)
 - ▶ Access to technology (Deolalikar 1981; Foster and Rosenzweig 2010)
 - ▶ Measurement error (Lamb 2003; Calogero et al. 2011)
- The U-shape relationship
 - ▶ Lumpiness of certain inputs - machinery soil preparation (Carter and Wiebe 1990 - Kenya)
 - ▶ Access to working capital (Dorward 1999 - Malawi)
 - ▶ Capacity to diffuse risk (Rosenzweig and Binswanger 1993; Kevane 1996 - Sudan; Heltberg, 1998 - Pakistan)
- Lack of focus on the medium-scale: operating 20 - 100 ha

Data Sources

- 1 The 2017 Emergent Farmers Survey (EFS), by IAPRI
 - ▶ 1,191 households owing 2,604 field plots
 - ▶ Farm size 0 - 95 ha
 - ▶ 2015/16 agricultural season, inputs and output for crop production
- 2 The Post-Harvest Survey (PHS), CSO
 - ▶ 11,360 households owing 31,473 field plots
 - ▶ Farm size 0 - 32 ha
 - ▶ 2015/16 agricultural season, inputs and output for crop production

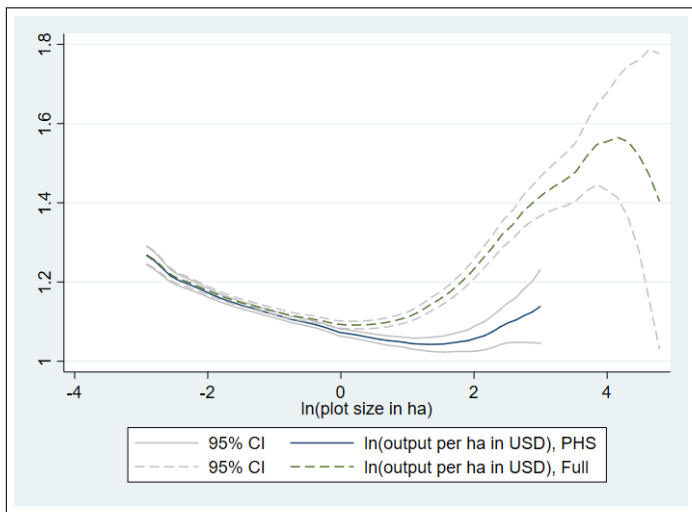
Descriptive Statistics

Table: Household crop production

	Total	EFS	PHS	
Total owned land area now (ha)	3.792	16.630	2.446	***
Total cultivated area now (ha)	2.861	9.366	2.179	***
Share did not cultivate any crop	0.004	0.039	0	***
Area share cultivated crops	0.856	0.707	0.872	***
Area % maize	0.655	0.728	0.648	***
Area % sunflower	0.024	0.027	0.024	
Area % groundnut	0.113	0.057	0.119	***
Area % soybean	0.064	0.082	0.062	***
Area % seed cotton	0.042	0.057	0.041	***
Crop yield: per ha value (USD)	820.84	1,023.71	800.40	***
Maize yield (kg/ha)	2,447.56	3,430.84	2,348.53	***
Sunflower yield (kg/ha)	58.66	80.42	56.47	***
Groundnut yield (kg/ha)	304.05	314.58	303.00	
Soybean yield (kg/ha)	74.72	247.25	56.63	***
Seed cotton yield (kg/ha)	82.13	118.31	78.33	***
Hired labor	0.925	0.397	0.978	***
Used herbicide, etc.	0.243	0.478	0.220	***
Used mineral fertilizer	0.702	0.951	0.677	***
Fertilizer input (kg/ha)	292.84	347.07	287.38	***
No. of households	12,551	1,191	11,360	

Plot Size and Crop Productivity

Figure: Yield and plot size, PHS and PHS+EFS



Farm Size and Productivity

Table: PHS sample only (N=31,473)

	Yield value, $\log(\$/ha)$					
$\log(\text{Field size})$	-0.142*** (0.008)	-0.092*** (0.009)	-0.090*** (0.010)	-0.151*** (0.006)	-0.116*** (0.010)	-0.108*** (0.006)
$\log(\text{Field size})^2$		0.032*** (0.004)	0.026*** (0.006)		0.020*** (0.006)	0.034*** (0.003)
$\log(\text{Field size})^3$			-0.002 (0.002)			0.002*** (0.000)
$\log(\text{Farm size})$				0.142*** (0.010)	0.241*** (0.031)	0.444*** (0.066)
$\log(\text{Farm size})^2$					-0.042*** (0.012)	-0.197*** (0.051)
$\log(\text{Farm size})^3$						0.033*** (0.012)
Crop inputs	Yes	Yes	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	No	No	No
Village FEs	-	-	-	Yes	Yes	Yes
R-squared	0.604	0.607	0.607	0.309	0.312	0.313

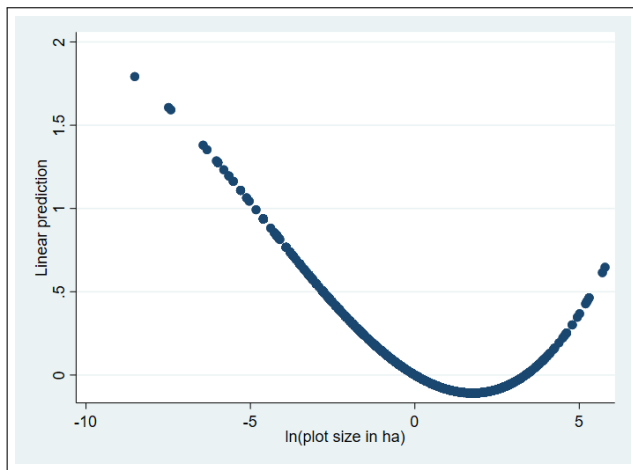
Farm Size and Productivity, continued

Table: PHS + EFS sample (N=34,077)

	Yield value, $\log(\$/ha)$					
$\log(\text{Field size})$	-0.139*** (0.008)	-0.101*** (0.008)	-0.100*** (0.011)	-0.148*** (0.005)	-0.119*** (0.008)	-0.117*** (0.006)
$\log(\text{Field size})^2$		0.027*** (0.005)	0.026*** (0.005)		0.019*** (0.005)	0.028*** (0.003)
$\log(\text{Field size})^3$			-0.001 (0.003)			0.002*** (0.000)
$\log(\text{Farm size})$				0.133*** (0.010)	0.246*** (0.028)	0.353*** (0.054)
$\log(\text{Farm size})^2$					-0.045*** (0.010)	-0.119*** (0.038)
$\log(\text{Farm size})^3$						0.014* (0.008)
Crop inputs	Yes	Yes	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	No	No	No
Village FEs	-	-	-	Yes	Yes	Yes
R-squared	0.606	0.609	0.609	0.331	0.334	0.335

The U-shape Relationship

Figure: The Relationship - size and productivity



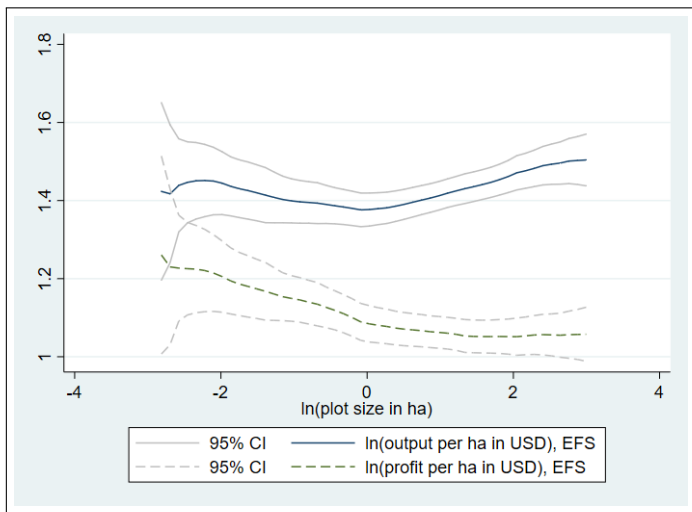
The Medium-Scale

Table: EFS sample only: Crop productivity and profit (N=2,604)

	Yield ($\log(\$/ha)$)		Profit ($\log(\$/ha)$)	
$\log(\text{Field size})$	-0.136*** (0.035)	-0.124*** (0.028)	-0.099*** (0.037)	-0.089*** (0.030)
$\log(\text{Field size})^2$	0.021* (0.012)	0.018* (0.010)	0.013 (0.014)	0.014 (0.011)
Hired labor	0.086 (0.074)	0.038 (0.050)	-0.054 (0.089)	-0.121** (0.059)
Fertilizer input (kg)	0.117*** (0.025)	0.131*** (0.020)	0.025 (0.029)	0.032 (0.023)
Other crop inputs	Yes	Yes	Yes	Yes
$\log(\text{Farm size})$	No	Yes	No	Yes
$\log(\text{Farm size})^2$	No	Yes	No	Yes
$\log(\text{Farm size})^3$	No	Yes	No	Yes
Household FEs	Yes	No	Yes	No
Village FEs	-	Yes	-	Yes
R-squared	0.577	0.449	0.565	0.422

The Medium Scale Puzzle

Figure: Yield and Profit Versus plot size, EFS



Capturing the Middle

- Crop productivity ↑ in size, but not profit
- More inputs? Higher cost?

Table: Inputs for crop production by farm size

	Total	<5 ha	5-10 ha	10-20 ha	>20 ha
Used mechanical soil preparation (%)	0.207	0.169	0.158	0.251**	0.40***
.. if yes, cost (USD/ha)	41.56	74.60	39.05	27.85 *	6.94**
Family labor (days/ha)	160.54	186.58	166.83	136.68	85.83**
Hired labor (%)	0.381	0.389	0.353	0.404	0.391
if yes, days/ha)	46.83	42.76	56.48	44.20	42.85
.... if yes, cost (USD/ha)	95.53	113.08	98.47	67.32**	79.83
Used organic fertilizer (%)	0.023	0.031	0.017	0.013	0.023
Used mineral fertilizer (%)	0.914	0.837	0.958***	0.969***	0.984***
if yes, use (kg/ha)	364.60	353.55	360.29	385.40	376.27
if yes, cost (USD/ha)	168.16	149.83	166.30	189.45***	195.92**
Used herbicide (%)	0.459	0.362	0.500***	0.53***	0.586***
if yes, cost (USD/ha)	46.15	51.61	45.20	38.06	47.57
Purchased seeds	0.937	0.858	0.98***	0.996***	1***
if yes, cost (USD/ha)	175.09	155.87	180.43	173.71	225.50

Summary

- Size and productivity:
 - ▶ Smallholders had more family labor input \Rightarrow the inverse relationship
 - ▶ The emergent farmers spent more on crop inputs \Rightarrow reduces profit
 - ▶ Per ha cost of mechanical use significantly went down \Rightarrow the U-shape
- The potential of the 'emergent farmers' in agricultural sector:
 - ▶ Support for access to working capital and credit, and capacity to cope with risk
 - ▶ Formality in tenure, and tenure security will be promising instrument