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Gender and Policy Effects on Technology Adoption in Zambia

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Abstract

This paper uses the Double-Hurdle model on panel household data for small scale farmers in Zambia to examine policy gender effects on technology adoption by farmers. Technology adoption in this paper is defined as fertilizer use by small-scale farm households. The paper uses the correlated random effects framework to account for unobserved heterogeneity between farmers and its correlation with explanatory variables used in the Double-Hurdle Model. A control function approach is used to account for potential endogeneity of subsidized input.

Objectives

I am looking at the effect of gender and its interaction with the fertilizer subsidy program on technology adoption.

My advances to the current literature of fertilizer use are:

- 1) Explore whether the results seem to be robust in other countries in Sub-Saharan Africa; and
- 2) Examine whether there are differences in the effectiveness of the fertilizer subsidy program by gender.

Survey Data

The data comes for the 1999/2000 Post-Harvest Survey (PHS) and the first, second and third supplemental surveys to the 1999/2000 Post-Harvest Survey.

Panel data for small scale households covers mainly the 1999/2000, 2002/03 and 2006/07 agricultural season.

Source: Zambia Central Statistical Office (CSO), the Ministry of Agriculture and Cooperatives (MACO) and the Food Security Research Project from the Food Research Group at Michigan State University.



Methods

Theoretical Model : non-Separable Household Model- De Janvry and Sadoulet (1995) to obtain reduced input demand equation as function of fertilizer input and maize price, fixed factors, farm characteristics, household socio-demographic characteristics, input subsidy and credit access.

Econometric Estimation:

Double Hurdle Model (Cragg, 1971): flexible approach to study corner solution dependent variables

$$q_{ijkt} = A_{ijkt} * q_{ijkt}^{**}$$

Hurdle 1: Fertilizer Market Participation

$$A_{ijkt} \sim \text{Binomial}(N_{ijkt}, \pi_{ijkt})$$

$$\Phi^{-1}(\pi_{ijkt}) = \Gamma'P + \beta'Z^q + \delta'Z^h + \alpha_1 S_{ijkt} + \alpha_2 G_{ijkt} + \alpha_3 (S_{ijkt} * G_{ijkt}) + \alpha_4 \text{prov}_{ijkt} + t + c_{ijkt}$$

Where, $\pi_{ijkt} = P(A_{ijkt} = 1 | Z^q, Z^h; S_{ijkt}; G_{ijkt}; \text{prov}_{ijkt}; \text{time})$

Hurdle 2: Intensity Demand Equation

$$q_{ijkt}^{**} \sim \text{LogN}(\mu_{ijkt}, \sigma^2)$$

$$\mu_{ijkt} = \Gamma'P + \delta'Z^h + \alpha_1 S_{ijkt} + \alpha_2 G_{ijkt} + \alpha_3 (S_{ijkt} * G_{ijkt}) + \alpha_4 \text{prov}_{ijkt} + t + c_{ijkt}$$

Significant Results- Hurdle 1

Independent Variable	Coefficient	p-value
Own Functioning Radio - third Survey (=1)*	0.25307	<0.0001
Own Cellphone(=1)*	0.39752	<0.0001
Information agricultural commodity prices (=1)**	0.12122	0.01017
Local Radio listening/Farm Forum Group (=1) **	0.21740	0.01477
Landholding Size(ha)*	0.03671	0.00689
Average fertilizer Price (kw/kg)*	-0.00076	<0.0001
Head Education(years) **	0.02551	0.02933
Value of livestock assets (1000 kw)***	0.00001	0.05186
Head Gender (=1 if female headed household)	-0.03285	0.59434
Subsidized Fertilizer (kg)*	0.01217	<0.0001
Subsidized Fertilizer by Gender Interaction	0.00887	0.12155

Significant Results- Hurdle 2

Independent Variable	Coefficient	Adjusted Coefficient	p-value
Residual from reduced form equation *	-0.001	-0.0008	<0.0001
Average fertilizer Price (kw/kg)*1	0.00024	0.0002	0.005
Head Gender (=1 if female headed household)***	-0.092	-0.0882	0.067
Subsidized Fertilizer (kg)*1	0.001	0.0014	<0.0001
Subsidized Fertilizer by Gender Interaction	0.00026	0.0003	0.275

Conclusion

- Subsidized input is a key factor on the small scale farmer's decision on whether to adopt new technology and the intensity of the adoption.
- Comparing households that participated in the market for fertilizer, unsubsidized female headed households use significantly less fertilizer than unsubsidized male headed households.
- Policy gender effects are non-significant at the two stages of the Double-Hurdle model. Results show that female headed households are not more responsive to the input subsidy than male headed households, both in terms of the decision of whether to adopt fertilizer technology and in the intensity of adoption.

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