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Determinants of Multiple Adoption in Ethiopia and Effects on Income: A Double Selection Model

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1. Background

- Population growth and environmental conditions require the increase of agricultural production in Ethiopia
- Numerous agricultural technologies (improved seeds, fertilizer, erosion control, etc.) available and propagated by the extension service
- Often reluctant uptake of innovations by smallholders

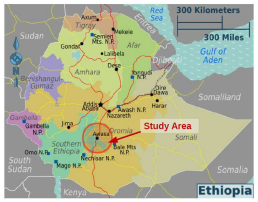
➢ Researchers widely ignore that farmers may choose from a bundle of possible innovations

➢ Few studies assess the effects of simultaneous adoption on household welfare

2. Objectives

- Investigate the interdependency of four different technology types
- Assess the effect of multiple adoption on income

3. Data and Methodology



- Survey of 398 households
- 200 km radius around Hawassa
- Multivariate probit model to identify determinants of multiple adoption
  Erosion mgnt., soil mgnt., chem. fertilizer, hybrid seeds
- Double selection model (Tunali, 1986) to estimate the effect of simultaneous adoption (hybrid seed, soil management) on income

$$ln\,(I) = \delta_1 Y_H + \delta_2 Y_S + \delta_3 Z + \lambda_H + \lambda_S + \eta$$

4. Results

- Are there interdependencies between technologies?

Correlation coefficient (ρ) estimates of adoption equation's error term

	Soil mgnt.	Chem. fertilizer	Hybrid seed
Erosion mgnt.	0.273***	0.284**	0.081
Soil mgnt.		0.180	0.385***
Chem. fertilizer			0.473***
Likelihood ratio test	Prob. > χ^2=0.000***		

- What encourages adoption?

Mprobit	Erosion management	Soil management	Chemical fertilizer	Hybrid seed
Risk (# shocks)	0.138	0.554 ***	0.092	0.648 ***
Age	0.004	0.023 ***	-0.007	-0.009
Household size	0.075 *	-0.028	0.058	0.106 ***
Dependency ratio	-1.047 **	0.803 *	0.823	-0.536
Education (yrs)	0.054 **	0.035	-0.007	-0.004
Extension contact [D]	0.395 **	0.421 **	0.687 ***	0.660 ***
Own cellphone [D]	0.252	0.454 **	0.612 ***	0.042
Helpnetwork (#)	0.008 **	0.016 ***	-0.004	-0.001
Women group [D]	0.918 ***	0.061	-0.227	0.131
Non-farm income [D]	-0.026	-0.120	-0.316 *	-0.088
Agric. Asset value	-0.060	0.006	-0.125	0.129 **
Hired labor [D]	0.202	-0.068	0.267	0.403 *
Shared labor [D]	0.048	0.202	0.620 ***	0.165
Market access [D]	0.003	-0.003 *	0.003	0.002
Altitude	0.000	0.000	0.000	-0.001 ***
Steep slope	1.122 ***	0.422	-0.632 *	-0.589 *
Good soil quality	0.896	0.357	0.927	1.004 *

N=398 *[D] dummy variable* *Only significant variables are displayed*

- Income effect of improved seeds and soil management

OLS regression	Ln (inc/capita)		Ln (inc/capita)
Improved seeds	-0.071	λ_1 (impr. seeds)	0.035
Soil management	0.007	λ_2 (soil mgnt)	-0.192 *
Household size	-0.144 ***	Livestock (TLU)	0.029 **
Dependency ratio	-0.686 **	Shared labor [D]	0.257 **
Extension contact [D]	0.223 *	Farmsize (ha)	0.292 ***
Helpnetwork (#)	0.006 ***	Med. water availability [D]	0.450 *
Non-farm income [D]	0.277 ***	High water availability [D]	0.604 **
Credit group [D]	0.296 **	Parcel distance (min.)	0.003 *

N=398 *R^2=0.401* *[D] dummy variable* *Only significant variables are displayed*

6. Conclusion

- Adoption of technologies are interdependent → *mvprobit*
- Factors encouraging adoption depend on the type of technology
- Risk stimulates adoption of soil management and improved seeds
- Social capital, non-farm employment, (financial) assets, water availability increase income
- Hybrid seeds and soil management show no significant income effect

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