Spillover effects of fertilizer subsidies on the adoption of improved seeds and the use of other modern inputs in Burkina Faso

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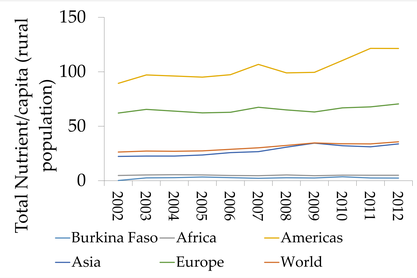
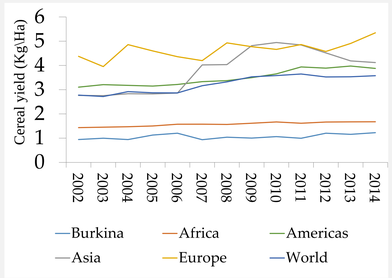
Background and motivation

- There is a consensus that low adoption rates of modern input in Africa explain to a large extent the low crop yields.





- To improve farmers' access to inputs, African governments often intervened in the market using subsidy programs.
- While these programs were phased out in the 1990s, they have resurfaced in the aftermath of the 07-08 food crisis.
- Responding to the 2006 Abuja Declaration on Fertilizer, the Government of Burkina Faso initiates a program in 2008 to provide fertilizer to farmers at a 15%-30% discounted price.
- The Burkina's subsidy program is universal, focuses on mineral fertilizer, and target food crops.

Research questions

- Exploiting this unique feature, this study assesses the effects of subsidizing one input on the use of other inputs.
- It puts forth and tests the hypothesis that farmers may be using mineral fertilizer as a substitute for -rather than a complement to- other technologies.
- The study fits in the new wave of empirical assessments of input subsidies programs.
- It contributes the literature on input studies in 3 aspects:
  - Geographical focus – first of its kind in Burkina Faso;
  - Outcomes of interest –fertilizer use, but also on the adoption of hybrid seeds, use of organic manure, and the use of crop protection chemicals;
  - Methods - efforts to convincingly address endogeneity and obtain robust findings.

Theory and Hypotheses

- We develop a model of nutrient demand as in Carter et al. (2014).
- Households are price takers, risk neutral, and maximize total consumption subject to budget constraint.
- They choose between traditional technologies and improved technologies that add soil nutrients to increase crop yield.
- Soil nutrients can be obtained from mineral fertilizer or mature.
- Fertilizer is purchased while organic manure is home-produced.
- Applying comparative statics to problem, we show that :
  - Fertilizer subsidies increase fertilizer demands;
  - Fertilizer subsidy crowd in manure in farmers perceived it as complementary to mineral fertilizer.

Empirical Approach

- We estimate household demand for mineral fertilizer, manure, hybrid seed, and plant protectants as functions of access to the subsidy program and other control variables
- We use multivariate probit to account for the simultaneously in input use decisions and address various estimation issues.
  - We address the endogeneity of fertilizer subsidy using instrumental variable estimation.
  - Instruments : household membership at a management position in an agricultural association /Total subsidized fertilizer received at village level.
  - Given the non-linearity of the multivariate probit model, we consider the control function approach.
  - Finally, we use the Correlated Random Effects approach to account for unobserved household heterogeneity.

Data

- Continuous Agricultural Survey (Enquête Permanente Agricole) for the years 2009-2010, 2010-2011, 2011-2012.
- Maize producers with a sample size of 2650 households
- 7.7% of farmers receive subsidy with average of 7.4 kg of N/Urea.
- Proportions using inputs are : 47% for fertilizer, 10% for hybrid seeds, 51% for manure, and 34% for protection chemicals.

Results

- Evidence of endogeneity of fertilizer subsidy.
- Membership to a farmers' organization strongly correlated with probability of receiving subsidies.
- Other determinants: farm size, being rice producer, household headship, and off-farm income.

Table 1: Multivariate regression of fertilizer subsidy and inputs use (various models)

	Mineral Fertilizer	Hybrid seeds	Organic manure	Protection chemicals
Treatment: Receipt of subsidized fertilizer [a]				
Control function multivariate probit	2.28***	1.71***	-1.04**	2.53***
IV – member of farmer group	(0.50)	(0.50)	(0.41)	(0.45)
Control function multivariate probit	0.75***	0.213*	-0.35***	0.48***
IV – village-level subsidized fertilizer	(0.14)	(0.13)	(0.11)	(0.11)

Partial table. All regressions include region and time fixed effects and account for unobserved heterogeneity using correlated random effects. *** p<0.01, ** p<0.05, * p<0.1

- Regression results confirm the simultaneity in input use decisions and the endogeneity of receipt of fertilizer.
- We find that fertilizer subsidies increase the probability of using mineral fertilizer.
- They also crowd in the use of hybrid seeds and crop protection chemical, but crowd out the use of manure.
- .Our results support the hypothesis that access to cheap fertilizer relaxes household's cash constraints and allow them to invest more money in purchasing hybrid seeds and crop protection chemical.

Summary and Implications

- Hybrids seeds and protection chemicals are complementary to fertilizer, while manure is perceived as a substitute.
- Subsidizing mineral fertilizer should be accompanied by measures (such as training) to encourage the use manure to sustainability enrich soil.

Selected References

Carter, M. R., Laajaj, R., & Yang, D. (2014). *Subsidies and the persistence of technology adoption: Field experimental evidence from Mozambique*. National Bureau of Economic Research.