

FERTILIZER SUBSIDIES & THE ROLE OF TARGETING IN CONDITIONING CROWDING IN/OUT: THE CASE OF TANZANIA

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Motivation

- Most ISPs re-introduced in SSA in last decade claim to be ‘smart’ (criteria from Morris et al 2007)
 - Subsidies targeted to sub-set of population (not universal), often via voucher
 - Subsidized quantity available per voucher is limited (i.e. enough subsidized fertilizer/seed for one acre)
 - Government role is to distribute vouchers; private sector role is to distribute subsidized & commercial fertilizer and redeem vouchers
- ISPs vary considerably by extent to which they are ‘smart’ in design & implementation (Wanzala et al, 2013)

Motivation

- Most of the recent ISPs in SSA have dual goals
 - Increase total fertilizer use on staple crop (maize, rice)
 - Improve household food security of poorer HHs
- If an input subsidy program (ISP) distributes 100,000 metric tons of fertilizer, how many **additional** tons of fertilizer are applied to farmers' fields?
 - Depends on extent to which receipt of subsidized fertilizer crowds in/out pre-existing smallholder fertilizer use on that crop

Motivation

- Evidence of crowding in/out from existing studies of ISPs is mixed -- varies by country and by context
- Crowding-out
 - Malawi (Ricker-Gilbert et al, 2013); Zambia (Xu et al, 2009); Mason et al, 2013); Kenya (Mather & Jayne, 2015)
 - Why? Too many vouchers went to farmers with **pre-existing use of market-priced fertilizer**
- Crowding-in
 - Pilot districts in Nigeria (Liverpool-Tasie, 2013); some areas in Zambia (Xu et al, 2009)
 - Why? Targeted farmers had low prior fertilizer use

Motivation

- Because crowding in/out varies by context, Tanzania makes an interesting case study of how displacement may vary by targeting criteria
 - NAIVS intended to target households that had not used fertilizer on maize/rice in previous 5 years
- Prior to NAIVS, not much fertilizer on maize/rice
 - 12% farmers use on maize (2007/08 Ag Census)
 - Southern highlands 21%; Lake zone 1% (2007/08)
 - 7% farmers use on rice (2007/08 Ag Census)

Background on NAIVS

- NAIVS 2008/09 to 2013/14
 - Reached 2.5 million households from 2008/09 to in 2012/13; \$US 300 million spent
 - Voucher recipient gets 3 vouchers → 50% subsidy on two 50kg bags fertilizer, 100% subsidy one bag of maize (rice) seed
 - Official household targeting criteria:
 - Resident farmer; grows no more than 1 ha of maize/rice
 - Has not used fertilizer on maize/rice 5 years
 - Ability to pay 50% market price of two 50 bags of fertilizer

Research questions

- Performance of NAIVS 2008/09 to 2012/13:
 - To what extent is official targeting criteria met in practice?
 - What is the effect of subsidized fertilizer on smallholders' quantity of commercial fertilizer purchased? Effect on total fertilizer use?
 - Does subsidized fertilizer crowd-in or crowd-out commercial fertilizer demand, on average..?

Data

- Rural household panel survey data
 - National Panel Survey 2008/09, 2010/11, 2012/13
 - Covers all zones targeted by NAIVS
 - N=1,467 HHs (unbalanced panel)
- Wholesale market crop prices by region
- Geo-spatial village-level data
 - Village-level elevation, rainfall, etc.

Methods

Empirical model for estimation (2-stage Cragg double hurdle)

Quantity of Commercial Fertilizer_{it} =

$\widehat{\beta}_1$ is the crowding-in/out estimate

$\beta_0 + \beta_1$ **Quantity Subsidized fertilizer_{it}** + **Other factors** + $c_i + v_{it}$

Methods

- 2) Test / control for potential endogeneity of household receipt of subsidized fertilizer

- 3) Test for panel attrition
 - Regression based test (Wooldridge, 2002) shows no evidence of attrition

Methods

- Prices

- price of urea fertilizer
- Naïve price expectation for maize, irish potatoes, coffee (nearest wholesale market)

- Market access (village)

- Distance to nearest grain market (km)
- Distance to nearest road (km)

Methods

- Agro-ecological (village-level)
 - Expected rainfall in wettest quarter (mm)
 - Elevation (m)
 - 1=soil does not retain nutrients well
 - Dummy variables for zones
 - Year dummies

Methods

- Household
 - Assets: total landholding, total farm asset value, head's age
 - Available family labor: # of adults age 15-64 (and its square)
 - Human capital: maximum adult education in HH
 - Demographics: # of children; # adults age 65+

Results: Targeting in practice

1) Among NAIVS voucher recipients

- Median area cultivated to maize not > 1 ha
- Most voucher recipients in 2008/09 had not used fertilizer on maize/rice in last 5 years (W.Bank/REPOA survey 2009/10)

2) However... Voucher leakage

- 25 to 37% voucher recipients did not redeem voucher for subsidized fertilizer
- If they sold the fertilizer, they receive cash/other, but this does not help meet goals of NAIVS

Results: Crowding in/out

- 1) On average, some crowding-in of smallholder commercial fertilizer demand in Tanzania
 - An additional kg of subsidized fertilizer increases commercial fertilizer demand by +0.12 kg, on average
 - If there had been no leakage.. An additional kg of subsidized fertilizer increases TOTAL fertilizer use by 1.12kg
 - Adjusting for leakage: average increase in TOTAL fertilizer use from each kg of subsidized fertilizer is +0.69 to 0.83 kg
- 2) Kenya average crowding-out/displacement (-0.43); Malawi (-0.18) & Zambia (-0.13)
 - Positive result in Tanzania driven by low % of voucher recipients who were using market-priced fertilizer previously on maize/rice

Policy Implications

- 1) One way to reduce leakage and improve NAIVS efficiency
 - Use a bottom-up approach to aggregating farmer demand for fertilizer, instead of top-down
 - Example from Burundi
 - Eligible farmers put up 20% many months before planting period, indicate what type of fertilizer they want & bag size
 - Importers bid for the opportunity to provide fertilizer demand district by district
 - Each farmer then pays additional 30% (or full price) at planting for his/her order

Policy Implications (2)

- 2) NAIVS is more efficient than other country input subsidy programs... yet it has already achieved its original goals:
 - Introduce many farmers to fertilizer use on maize/rice
 - Foster longer-term investment by fertilizer/seed supply chains
- 3) Its potential for income growth (aggregate & distributional) should be compared with other kinds of investments
 - Traditional public goods (ag research, extension, rural roads, better port facilities, etc)
 - Fan et al (2008); EIU (2008) found highest rates of return (Asia) to favorable policy environment, ag R&D and roads

Policy Implications (3)

- 4) Results from productivity/profitability research suggests that URT take a more holistic approach to improving smallholder maize productivity
 - Smallholders need more than just better physical access to fertilizer (i.e. NAIVS) to develop sustainable increase in maize productivity
 - Smallholder maize-Nitrogen response rates are very low ... < 50% of rates from zonal research centers
 - a) Maize-N response rates can be raised
 - Promotion of fallowing, improved varieties, & other soil fertility improvement methods

Policy Implications (4)

- 4) Results from productivity/profitability research suggests that URT take a more holistic approach to improving smallholder maize productivity
 - b) Need for higher expected maize price levels → requires a more predictable maize trade policy
 - c) Need for public good investments to lower fertilizer costs
 - Make TFRA a true 'one-stop' regulatory agency at port
 - Improve port facilities
 - Rural roads

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