



Taking stock of Africa's second-generation input subsidy programs: Insights from 70+ empirical studies

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Presentation objectives

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- To share the key insights from 70+ empirical studies on the targeting and impacts of input subsidy programs (ISPs) in sub-Saharan Africa (SSA) since the early 2000s
- To highlight the implications for the design/re-design of ISPs and agricultural development strategies more broadly
- To point IAPRI researchers to resources that can help them with potential future research on ISPs

Overview

- Proliferation of empirical studies on ISPs in SSA since the late 2000s
- Most focus on Malawi, Zambia, Nigeria, Tanzania, Kenya, or Ghana
- **Broad themes**
 - **Targeting:** Who receives subsidized fertilizer?
 - **Household-level effects**
 - Fertilizer & improved seed use
 - Crop yields, production, & area planted
 - Other soil fertility and natural resource management practices
 - Crop income & marketing
 - Total HH income & poverty
 - Dynamic or enduring effects – i.e., do the effects of ISPs persist over time?
 - **Aggregate-level effects**
 - National fertilizer use
 - Food prices
 - Wage rates & labor markets
 - Aggregate poverty rate
 - **Political economy:** Targeting and effects on voting/election results

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TARGETING

Targeting: Who receives subsidized fertilizer? (1)

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Male- vs. female-headed HHs:

- Generally no major differences
- But where differences exist, **female-headed HHs** are **LESS** likely to get it (e.g., some studies for Malawi Farm Input Subsidy Program (FISP), Tanzania National Agricultural Input Voucher Scheme (NAIVS), Nigeria Growth Enhancement Support Scheme (GES))

Sources: See Jayne et al. (2018) for details

Targeting: Who receives subsidized fertilizer? (2)

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Landholding size or area cultivated:

- Almost all studies suggest **HHs w/ more land get more**

Share of Zambia FISP fertilizer received by farm size 2010/11 agric. season)

Hectares cultivated	% of total HHs	% of total FISP fertilizer
0-0.49	17.0	2.5
0.5-0.99	72.5% 23.6	45.1% 13.0 (43 kg)
1-1.99	31.9	29.6
2-4.99	23.5	41.0
5-9.99	27.5% 3.3	54.9% 10.7
10-20	0.6	(346 kg) 3.2
All HHs	100	100

Sources: Jayne et al. (2011), Mason et al. (2013)

Sources: See Jayne et al. (2018) for details

Targeting: Who receives subsidized fertilizer? (3)

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- **Assets, income, or poverty status prior to the program:**
 - **Malawi FISP:** Very mixed results (many different studies/measures used)
 - **Ghana Fertilizer Subsidy Program (GFSP):** asset wealth 44% higher among GFSP beneficiaries
 - **Zambia FISP:** richest 20% of HHs receive 43% of FISP fertilizer (income)
 - **Kenya (asset wealth):**
 - National Accelerated Agricultural Inputs Access Program (NAAIAP): richest 20% of HHs less likely to receive than poorest 80%
 - National Cereals and Produce Board (NCPB): no effect

Sources: Malawi (see Jayne et al. 2018), Ghana (Vondolia et al. 2012), Zambia (Mason et al. 2017 supplemental tables), Kenya (Sheahan et al. 2014, Mather & Jayne 2015)

Targeting: Why does this matter?

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- If large share of subsidized fertilizer is going to **HHs that were already relatively better off**, the program is **less likely to achieve poverty reduction goals**
- HHs with more land, assets, or wealth before the subsidy program (and male-headed HHs) are **more likely to have been using fertilizer**
 - → **Some of the subsidized fertilizer** allocated to them just **replaces what they would have purchased otherwise (“displacement”)**

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HOUSEHOLD-LEVEL EFFECTS OF ISPs

Effects of ISPs on **fertilizer use** (1)

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- **Question:** *If Mr. Zulu, a Zambian farmer, receives 100 kg of fertilizer through FISP, by how much will his total fertilizer use increase?*
- a. 100 kg
 - b. Less than 100 kg
 - c. More than 100 kg
 - d. It depends

It depends!

Effects of ISPs on fertilizer use (2)

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- **8 of 10 country studies:**
100 kg subsidized fertilizer → < 100 kg increase in fertilizer use
 - Zambia FISP (similar for maize seed): 87 kg
 - Malawi FISP (similar for maize seed): 82 kg
 - Kenya NAAIAP & NCPB: 57 kg
 - Nigeria Federal Market Stabilization Program (FMSP): kg estimate not available

- **2 of 10 country studies:**
100 kg subsidized fertilizer → > 100 kg increase in fertilizer use
 - Tanzania NAIVS: 110 kg
 - Nigeria voucher pilot program in Kano State (KVSP): 126 kg

Sources: See Jayne et al. (2018) and Ariga et al. (2018) for details.

Effects of ISPs on fertilizer use (3)

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What explains crowding out?

- Significant share of ISP fertilizer targeted to farm HHs that **would have purchased fertilizer at market prices even without the subsidy**
- These tend to be:
 - HHs with **more land** or other **assets**
 - **Male-headed** HHs
- Except for Kenya NAAIAP – all ISPs with crowding out only **minimally involved the private sector for fertilizer component of program**

Effects of ISPs on fertilizer use (4)

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What explains crowding in?

- **Both Tanzania/NAIVS & Nigeria/KSVP:**
 - Utilized **vouchers redeemable at private sector** retailers' shops
- **Tanzania/NAIVS:**
 - Did good job of **targeting HHs that hadn't used fertilizer** on maize or rice in the last 5 years (75% of beneficiaries)
- **Nigeria/KVSP:**
 - Subsidy for 3 X 50-kg bags. **Not enough to meet full demand** → farmers purchase the rest at market price at agrodealer?
 - Input suppliers required to be **physically present** in LGAs
 - Pilot program **closely monitored** by IFDC

Effects of ISPs on crop production & yields

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- Generally **small, positive effects on maize production and yields**
 - 1.7 – 3.6 additional kg of maize produced / kg subsidized fertilizer
- **Why so small?**
 - **Displacement/crowding out** (previous slides)
 - **Late delivery**
 - **Agronomic factors** (next slides)

Maize yield response to N on smallholders' plots in SSA

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- **5 to 26 kg maize/kg N**, with most estimates < 15 kg maize/kg N
 - ▣ Based on 15 studies using data from smallholders' fields over multiple years
 - ▣ Much lower than in researcher-managed trials (18 to 40 kg/kg)

- **Low maize yield response →**
 ↓ **profitability of fertilizer use**
 - ▣ In many cases, benefits < costs



Sources: See Jayne et al. (2018) for details.

Source: CIMMYT

Why is maize yield response so much lower on farmers' plots?

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Source: <https://siawere.wordpress.com>

1. **Poor water availability** (mostly rain-fed)
2. **Poor soil quality** (esp. high soil acidity and low soil organic matter)
 - ▣ Growing populations → continuous cultivation and reduced fallows
 - ▣ Fallowing, minimum tillage, manure/compost, intercropping or rotating with legumes, and crop residue retention can help but constraints
3. **Uniform fertilizer types/recommendations**

→ *In many areas, increasing profitability of fertilizer use will require addressing underlying soil quality & agronomic issues. ISPs alone will not solve the problem.*

Effects on ISPs on **other soil fertility management & natural resource management practices**

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- ISPs might encourage or discourage farmers to make **longer-term investments in soil and land** - e.g.,
 - ↓ fertilizer prices → free up resources → ↑ investment
 - ↑ fertilizer use → ↑ labor needed for fertilizer & harvest → ↓ investment
- **Empirical evidence**
 - Most studies (Malawi, Zambia, Ghana) suggest **NO ISP effects** on use of **manure, minimum tillage, or other SLM practices** (e.g., terraces, stone bunds, vegetative strips, etc.)
 - But some evidence that **Zambia FISP ↓ fallowing and ↑ maize monocropping and continuous maize cultivation**

Sources: Malawi (Holden & Lunduka 2012, Kassie et al. 2015, Koppmair et al. 2017), Ghana (Vondolia et al. 2012), Zambia (Levine 2015, Morgan et al. 2018)

Effects on ISPs on **crop area planted**

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- **Zambia (relatively land abundant):**
 ↑ maize & total area; no adverse effects on area planted to other crops
 - Some of additional area = fallow land
- **Kenya (relatively land scarce):**
 no effects on area planted
- **Malawi (relatively land scarce):**
 mixed findings re: maize % of area



Source: Joel DeJong

Sources: Zambia (Mason et al. 2013), Kenya (Mason et al. 2017), Malawi (Chibwana et al. 2012, Holden & Lunduka 2010, Karamba 2013)

Effects of ISPs on **crop income & marketing**

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□ **Net crop income**

- Generally small, positive effects
(Malawi FISP, Zambia FISP, Kenya NAAIAP (among poor))
 - Subsidy ↓ fertilizer price + ↑ maize output

□ **Maize marketing**

- Malawi FISP & Nigeria GES:
 - ↑ maize sales



Sources: Kenya (Mason et al. 2017), Zambia (Mason et al. 2018), Malawi (Ricker-Gilbert Jayne 2012, Sibande et al. 2017), Nigeria (Wossen et al. 2017)

Source: Malawi 24

Effects of ISPs on **total HH income & poverty**

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Source: Smallstarter.com

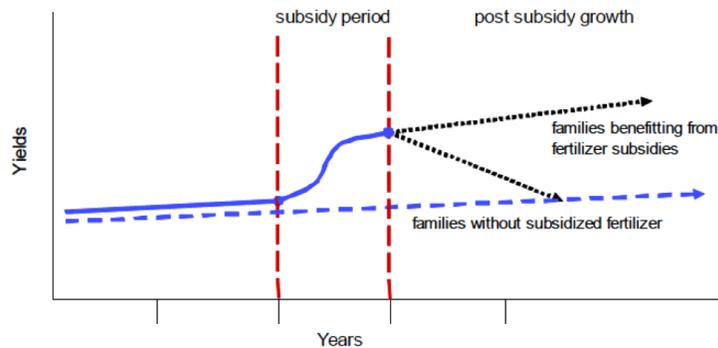
- **Malawi:** mixed effects
- **Zambia FISP, Kenya NAAIAP, & Nigeria GES:** small ↑ in total HH income/expenditure and/or ↓ in poverty incidence, gap, or severity

Sources: Kenya (Mason et al. 2017), Zambia (Mason et al. 2018), Malawi (Ricker-Gilbert Jayne 2012, Chirwa 2010), Nigeria (Wossen et al. 2017)

Do ISPs have **enduring effects** on beneficiary HHs? (1)

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- The hope is that by ↑ fertilizer use, yields, and incomes, ISPs will build beneficiary HHs' assets & put them on a more positive yield & welfare trajectory



Source: Carter et al. 2010

Do ISPs have **enduring effects** on beneficiary HHs? (2)

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- Few studies, mixed results
- **Malawi:**
 - Commercial fertilizer demand: **initial crowding-out** but **possible crowding-in in the longer run** (e.g., 3 years later)
 - But **no evidence of enduring effects** on maize production, assets, or income
- **Mozambique:**
 - **Positive effects** on crop production and HH expenditures **persist 3 years later**
 - Much **lower initial fertilizer use** than Malawi; persistent effects could in part be due to **learning and/or subsidy pilot program/IFDC efforts** to improve fertilizer supply and expand agro-dealer networks

Sources: Malawi (Ricker-Gilbert & Jayne 2011, 2017), Mozambique (Carter et al. 2014)

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AGGREGATE-LEVEL EFFECTS OF ISPs

Effects of ISPs on national fertilizer use

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- Discussed earlier how 100 kg of subsidized fertilizer often increases HH fertilizer use by < 100 kg
- **Diversion** and resale of fertilizer intended for ISPs further reduces the effects of ISPs on national fertilizer use
- Malawi, Zambia, and Tanzania: Empirical evidence suggests **25-33% of ISP fertilizer is diverted**
 - ▣ Increase in national fertilizer use given 100 MT increase in ISP fertilizer:
 - Malawi: 55 MT (82 MT w/o accounting for diversion)
 - Zambia: 58 MT (87 MT w/o accounting for diversion)
 - Tanzania: 83 MT (110 MT w/o accounting for diversion)

Sources: Malawi & Zambia (Jayne et al. 2015), Tanzania (Mather & Minde 2016)

Effects of ISPs on food prices

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- By ↑ staple food production, might expect ISPs to ↓ food prices
 - Would positively affect urban consumers and rural net buyers
- **Malawi & Zambia FISP:** retail **maize prices** ↓ 1-4%
- **Malawi FISP:** overall **food prices** ↓ 2-3%
- **Nigeria FMSP:** **no effect** on maize or rice prices

Sources: Ricker-Gilbert et al. (2013), Arndt et al. (2016), Takeshima & Liverpool-Tasie (2015)

Effects of ISPs on wage rates & labor markets

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- If ISPs ↑ incomes → might ↑ demand for labor → could ↑ wage rates
 - Could positively affect laborers
- **Malawi FISP:**
 - ↑ **wages** but by how much varies across studies (1% vs. 5-8%)
 - Also some evidence of ↑ **demand (and ↓ supply) for ganyu labor**

Sources: Ricker-Gilbert (2014), Arndt et al. (2016)

Effects of ISPs on **overall poverty rates**

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- Evidence base is thin
- Arndt et al. (2016): 2006/07 Malawi FISP **reduced national poverty headcount ratio by 2-3 percentage points** (against baseline poverty rate of 52%)

Sources: Ricker-Gilbert (2014), Arndt et al. (2016)

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THE POLITICAL ECONOMY OF ISPs

Political economy of ISPs: **Targeting**

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- **Mounting evidence of politicized targeting of ISPs**
- **Politically connected HHs tend to get more subsidized fertilizer**
 - Tanzania NAIVs: HHs w/ elected officials
 - Malawi FISP: HHs in villages w/ MP
 - Nigeria FMSP: HHs in villages closer to state governor's district of origin
- **Mixed results re: which voters or constituencies are targeted**
 - Ghana: opposition strongholds
 - Zambia: core supporter constituencies
 - Malawi: mixed

Sources: Pan & Christiaensen (2012), Ricker-Gilbert & Jayne (2011), Sibande et al. (2017), Banful (2011), Mason et al. (2017), Takeshima & Liverpool-Tasie (2015), Malawi mixed results— see Jayne et al. (2018) for details

Political economy of ISPs: **Effects on voting/elections**

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- **Conventional wisdom** is that fertilizer subsidies win votes, i.e.:
 - Assumptions:
 - Scaling up ISPs politically beneficial
 - Scaling down ISPs politically damaging
- **Does the empirical evidence support this?**
 - **Not really!**
 - Some evidence that Malawi FISP increased support for President Mutharika and his Democratic Progressive Party in the 2009 election
 - BUT evidence from Zambia suggests the Zambia FISP had NO EFFECT on presidential election results in 2006 and 2011

Sources: Brazys et al. (2015), Dionne and Horowitz (2016), Mason et al. (2017)

Conclusions & Policy implications (1)

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- **Bottom line: ISPs can raise fertilizer use and crop production** in the short-run but **impacts have been smaller than expected**, largely due to:
 - **Displacement** of unsubsidized fertilizer purchases
 - **Low crop yield response** to fertilizer
- **Targeting HHs that were not using fertilizer before the program can help** reduce displacement and increase ISPs' impacts – e.g.,
 - Female-headed HHs
 - HHs with enough land to use the input packet but on the lower end of the landholding size and wealth spectrum
 - Work through private agro-dealers rather than parallel ISP distribution system

Conclusions & Policy implications (2)

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- **Need to address underlying soil issues** that constrain crop yield response to fertilizer or ISP effects on crop yields will continue to be disappointing and profitability of fertilizer use will remain low
 - Low soil organic matter
 - High soil acidity
- **Need to move beyond blanket recommendations & uniform input packs**
- **Need efforts to ↓ farm gate fertilizer prices and ↑ farm gate crop prices**
 - Bulk procurement of fertilizer (?), invest in rural roads, promote competition

Conclusions & Policy implications (3)

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- Remember that ISPs are just one option and that **heavy expenditures on ISPs = less \$\$ available for other important programs/investments** to improve ag productivity and reduce rural poverty

Investments & subsidies in rural India during the 1990s ranked by ag growth & rural poverty returns
(↑ in ag GDP or ↓ in # of poor people per Rupees spent)

Investment or subsidy (Source: Fan et al. 2008)	Rank w.r.t. returns to:	
	Ag growth	Poverty reduction
Agricultural R&D	1	2
Roads	2	1
Education	3	3
Irrigation investment	4	5
Credit subsidies	5	4
Irrigation subsidies	6	6
Power subsidies	7	7
Fertilizer subsidies	8	8

Suggestions for IAPRI researchers

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- Paper is open access and available for free download here:
 - <https://www.sciencedirect.com/science/article/pii/S0306919217308618>
 - Appendices are available at the bottom of the link at the page above or directly here: <https://www.sciencedirect.com/science/MiamiMultiMediaURL/1-s2.0-S0306919217308618/1-s2.0-S0306919217308618-mm2.docx/271787/html/S0306919217308618/4fd066b4a6fba07342a2d5bb681e6e84/mm2.docx>
- Check out the main paper but also the appendices
 - Appendix B has very rich information on the nearly 80 studies covered in the lit review, including main findings, data used, gist of methods, etc.
 - This appendix can also point you to knowledge gaps in the literature
- Please get in touch if you're interested in collaborating with me on research on FISP!

Thank you! Questions or comments?

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