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

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 FISP, Tanzania NAIVS, Nigeria 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	23.6	13.0
1-1.99	31.9	29.6
2-4.99	23.5	41.0
5-9.99	3.3	10.7
10-20	0.6	3.2
All HHs	**100**	**100**

72.5% (43 kg) 45.1%

27.5% (346 kg) 54.9%

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 GFSP:** asset wealth 44% higher among GFSP beneficiaries
  - **Zambia FISP:** richest 20% of HHs receive 43% of FISP fertilizer (income)
  - **Kenya** (asset wealth):
    - NAAIAP: richest 20% of HHs less likely to receive than poorest 80%
    - 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 FMSP: kg N/A
- **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: 126 kg
- We'll discuss the reasons why and implications for ISP design on Thursday

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

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 slide)
  - **Late delivery**
  - **Agronomic factors** (next slides)

Sources: Malawi (Ricker-Gilbert & Jayne 2012), Zambia (Mason et al. 2013), Kenya (Mason et al. 2017), Nigeria (Wossen et al. 2017)

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


Source: CIMMYT

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

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

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)

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

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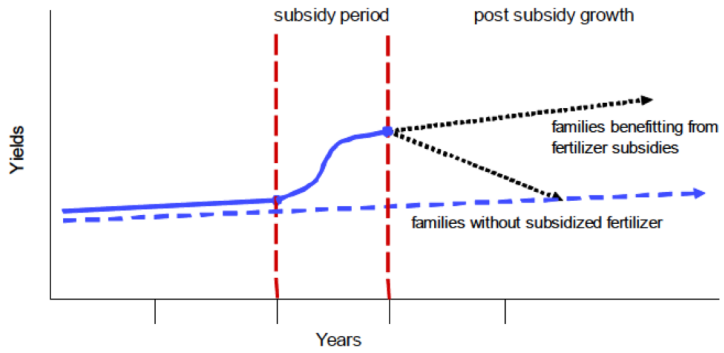
- The hope is that by ↑ fertilizer use, yields, and incomes, ISPs will build beneficiary HHs' assets & put them on a more positive yield & welfare trajectory



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 subsides 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

Thank you! Questions or comments?

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