Do input subsidies reduce poverty among smallholder farm households? Evidence from Zambia

Nicole M. Mason
Assistant Professor
Michigan State University, Dept. of Agricultural, Food, & Resource Economics

Solomon T. Tembo
Senior Research Associate
Indaba Agricultural Policy Research Institute – Lusaka, Zambia

Motivation

- Input subsidy programs (ISPs) = cornerstone of many SSA countries’ agric. sector & poverty reduction strategies

- ISP objectives:
  1. Increase access to and use of modern inputs
  2. Raise crop yields and production
  3. Improve food security and reduce hunger
  4. Raise incomes and reduce poverty

- Most research focused on #1 & 2, less on #3 & #4
Motivation (cont’d)
Zambia & Malawi – large ISPs for decade+ but rural poverty rates high & virtually unchanged

Sources: CSO (2009, 2011), MACO (various years), MAL (various years). Note: Rural poverty rates based on the national poverty line.

Motivation (cont’d)

Might poverty rates have been even higher without the ISP?
Research question

What are the *ceteris paribus* effects of fertilizer received through Zambia’s subsidy program on smallholder HH incomes and poverty?

Outline

- Previous studies
- Zambia’s ISP
- Data & methods
- Results & discussion
- Policy implications
Previous studies: ISPs & incomes/poverty

**Zambia**
- Mason & Smale (2013) – subsidized hybrid maize seed increases incomes and reduces poverty but by small magnitudes
- 1st paper on effects of sub. fertilizer on incomes/poverty

**Other SSA countries**
- Nigeria: Awotide et al. (2013)

Zambia’s Input Subsidy Program

- Farmer Input Support Program (FISP)
- 2004-2011: 47% of ag sector Poverty Reduction Programme spending
- “The overall intention of [FISP] was to improve incomes, hence reduce poverty…” (Minister of Agriculture & Livestock, 27 June 2013)
Data

Two nationally-representative survey datasets of smallholder farm HHs

1. **Supplemental Survey (SS, panel)**
   - 1999/2000, 2002/03, & 2006/07 agricultural years
   - 4,286 HHs in balanced panel

2. **Rural Agricultural Livelihoods Survey (RALS, cross-section)**
   - 2010/11 agricultural year
   - 8,839 HHs
   - Focus on SS results here (stronger case for causality)

Methods

- Conceptual framework adapted from Otsuka et al. (1992)
  \[ y_{i,t} = \beta_0 + \beta_1 FISP_{i,t} + \beta_2 w_{i,t} + \beta_3 p_{i,t-1} + \beta_4 k_{i,t} + \beta_5 l_{i,t} + \beta_6 z_{i,t} + c_i + u_{i,t} \]
  - Income / poverty \((y)\) of HH \(i\) in year \(t\) is a function of:
    - Kg of subsidized fertilizer acquired \((FISP)\)
    - Factor prices \((w)\)
    - Expected crop prices – naïve expectations \((p)\)
    - Land & other farm assets \((k)\)
    - HH labor supply, proxies for labor quality & mgmt ability \((l)\)
    - Other shifters \((z)\)

- Panel data methods (FE, CRE) – corr\((X_{i,t}, c_i)\)
- IV / control function approach – corr\((FISP_{i,t}, u_{i,t})\)
  - Past election results in the HH’s constituency
Outcome variables & estimators

1. **Real income (total, crop, other)** – HH and per adult equivalent – FE, CRE Tobit

2. **Poverty incidence** (binary) – CRE probit
   - US$2 and US$1.25 per capita per day

3. **Poverty severity** (proportion) – CRE fractional response
   - Gross income and income net of fertilizer costs

Smallholder poverty rates – US$1.25/day

<table>
<thead>
<tr>
<th>Agricultural year</th>
<th>Supplemental Survey</th>
<th>RALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999/2000</td>
<td>7%</td>
<td>30%</td>
</tr>
<tr>
<td>2002/03</td>
<td>9%</td>
<td>33%</td>
</tr>
<tr>
<td>2006/07</td>
<td>11%</td>
<td>30%</td>
</tr>
<tr>
<td>2010/11</td>
<td>11%</td>
<td>78%</td>
</tr>
</tbody>
</table>


Note: Conversions to US$ based on 2005 PPP exchange rate and adjusted for inflation (World Bank World Development Indicators).
Bivariate: FISP recipients statistically significantly better off in all dimensions

- Incomes roughly double
- Poverty incidence 7-12 pp lower
- Poverty severity 15-18 pp lower

Do these results hold up when we control for other factors?

Multivariate: large, positive income effects (via crop income) but small poverty effects

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Estimated Δ per 200-kg increase in FISP fertilizer</th>
<th>Sig.</th>
<th>p-value</th>
<th>% Δ from mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net HH income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop</td>
<td>K663,400 (US$129)</td>
<td>***</td>
<td>0.004</td>
<td>+28.2%</td>
</tr>
<tr>
<td>Other</td>
<td>K231,010</td>
<td></td>
<td>0.513</td>
<td></td>
</tr>
<tr>
<td>Net HH income/AE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop</td>
<td>K114,600 (US$22)</td>
<td>***</td>
<td>0.002</td>
<td>+21.2%</td>
</tr>
<tr>
<td>Other</td>
<td>K 54,340</td>
<td></td>
<td>0.375</td>
<td></td>
</tr>
<tr>
<td>Poverty incidence (net)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2/day</td>
<td>-0.5 pp</td>
<td>**</td>
<td>0.036</td>
<td>-0.5%</td>
</tr>
<tr>
<td>$1.25/day</td>
<td>-1.0 pp</td>
<td>***</td>
<td>0.009</td>
<td>-1.1%</td>
</tr>
<tr>
<td>Poverty severity (net)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2/day</td>
<td>-1.3 pp</td>
<td>*</td>
<td>0.053</td>
<td>-2.0%</td>
</tr>
<tr>
<td>$1.25/day</td>
<td>-2.0 pp</td>
<td>***</td>
<td>0.008</td>
<td>-3.7%</td>
</tr>
</tbody>
</table>

Notes: *** p<0.01, ** p<0.05, * p<0.10. Income is in real terms (2011/12=100).
**Why** the **large, positive income effects** but **small poverty effects?**

- **Large share of FISP goes to better off HHs**
  - 2006/07:
    - 61% of FISP went to the richest 20% of HHs
    - 7% of FISP went to the poorest 40% of HHs

- **Poverty is deep and severe**
  - Income effects not large enough to lift above poverty line

**Note:** effects on retail maize prices minimal (Ricker-Gilbert et al., 2013) → don’t expect major impacts on rural poverty through food prices

---

**Policy implications I: How to improve poverty impact of FISP?**

1. **Better target poor smallholders**
   - a. **Revise eligibility requirements to be pro-poor**
     - Coop membership and farmer payment > 20% of income for 60% of smallholders (Burke et al., 2012)
   - b. **Reduce scope for better-off HHs to capture most of the benefits**
     - Limit to HHs cultivating 0.5-2 ha of land (60% of the poor)
     - Combat diversion

2. **Increase the effects on production & incomes**
   - a. Raise maize-fertilizer response rates
   - b. Reduce crowding out of commercial fertilizer
Policy implications II: If poverty reduction is the objective, is FISP the best option?

- Social cash transfers
- Investments in ag R&D, rural infrastructure, health, and education
- Need Zambia-specific empirical evidence!

Thank you for your attention! Questions?

Nicole M. Mason  
http://www.afre.msu.edu/people/mason  
masonn@msu.edu

Solomon T. Tembo  
solomon.tembo@iapri.org.zm

MSU Dept. of Agricultural, Food, & Resource Economics  
http://www.afre.msu.edu/

Indaba Agricultural Policy Research Institute  