Political economy dimensions of input subsidy programs: Fertilizer subsidies & election outcomes in Zambia

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“But there is no doubt that this Farmer Input Support Programme, which is supposed to be an economic activity, has sadly been abused or mismanaged by politicians and those seeking patronage and turned into a political tool for their election campaigns… And in this election year things will be worse – it will be nothing but a campaign tool; fertiliser bought with taxpayers’ money will be exchanged for votes.”

Fertilizer subsidies in SSA: An old tool in a new political context

- 1960s/1970s: universal subsidies; dictatorships or one party rule
- 1980s/1990s: scaled back/eliminated
- Today:
  - 10 countries, US$1.05 billion in 2011 (Jayne & Rashid, 2013)
  - Targeted & universal subsidies; multi-party democracy
- Stated objectives:
  - Increase access to inputs, productivity, & production
  - Raise incomes, reduce poverty, improve food security
- Other objectives:
  - “Do something” for rural constituents (Jayne et al., 2010)
  - Garner and maintain rural votes

Election outcomes

Fertilizer subsidies

?
**Multivariate results**

- Ghana (Banful, 2011) & **Kenya (Jayne et al., 2013): opposition**
- **Malawi & Zambia (Mason & Ricker-Gilbert, 2013): supporters**
- Malawi (Dionne & Horowitz, 2013): partisanship has no effect
- Tanzania (Pan & Christiaensen, 2012): elected officials
- **Nigeria (Takeshima & Liverpool-Tasie, 2013): LGAs close to state governor’s LGA of origin**

**Political economy not focus; political variables used as IVs for subsidized fertilizer**

**Malawi**

- Descriptive/anecdotal: fertilizer subsidies instrumental in Mutharika’s 2009 landslide victory (Smiddy & Young, 2009; Chinsinga, 2010, 2012; Ferree & Horowitz 2010; Mpesi & Muriaas, 2012)

- **Multivariate**: Dionne & Horowitz (2013) – receiving voucher in 2009 ↑ likelihood that “feel close to” Mutharika’s party in 2010

**Dionne & Horowitz (2013) is the only study (other than ours) that has attempted to quantify this relationship**
Research questions

1. Do past election outcomes affect subsequent targeting of subsidized fertilizer?

2. Do past subsidized fertilizer allocations affect subsequent election outcomes?

Contributions

1. Analyze both directions of the relationship
   - Add to very thin evidence base on fertilizer subsidies → election outcomes
   - Explore election outcomes → fertilizer subsidies in more detail, robustness checks

2. Panel data methods
   - 2 most detailed previous studies (Banful, 2011; Dionne & Horowitz, 2013) use cross-sectional data on subsidized fertilizer

3. Fractional response model w/ CRE & CF
Outline

- Zambia, elections, and fertilizer subsidy programs
- Methods, data, results
  1. Election outcomes ➔ subsidized fertilizer?
  2. Subsidized fertilizer ➔ election outcomes?
- Conclusions & policy implications

Zambia

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>Size</td>
<td>&gt; Texas</td>
</tr>
<tr>
<td>Population</td>
<td>14.6 mil</td>
</tr>
<tr>
<td>% Rural</td>
<td>61%</td>
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<tr>
<td>Agric. % of labor force</td>
<td>85%</td>
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<tr>
<td>GDP/capita (PPP)</td>
<td>$1,800</td>
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<td>Poverty rate (2010):</td>
<td>61%</td>
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<tr>
<td>Rural</td>
<td>78%</td>
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<tr>
<td>Urban</td>
<td>28%</td>
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Maize
- 87% of smallholders grow it; ~60% of national calorie consumption
- >85% of government ag spending = maize incentives
  (input subsidies & Food Reserve Agency (FRA))

Elections & ruling parties

- Multi-party elections since 1991
- Presidential & parliamentary elections every 5 years
- Plurality system – candidate w/ most votes wins

**Movement for Multi-Party Democracy (MMD)**
Ruling party 1991-2011

**Patriotic Front (PF)**
Defeated MMD in 2011

Fertilizer subsidies & timing of elections

<table>
<thead>
<tr>
<th>Year</th>
<th>Subsidized Fertilizer ('000 MT)</th>
<th>MMD</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>Nov. 1996: Chiluba (landslide)</td>
<td>Chiluba (landslide) → FCP (200-800 kg)</td>
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<tr>
<td>1999</td>
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<td>2014</td>
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<tr>
<td>2015</td>
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</tbody>
</table>

Source: MAL (2014)
Do past election outcomes affect the targeting of subsidized fertilizer to smallholder HHs?

Effects of past election outcomes on HH-level subsidized fertilizer targeting

**Conceptual framework**
- Eligibility criteria established by government
  - Capacity to cultivate 1-5 ha of maize
  - Ability to pay farmer share of input costs (40-50%)
  - Cooperative membership
- Theories of redistributive politics
  - “Core supporter”/turnout model (Cox & McCubbin, 1986)
- → Reduced form model of government behavior
  - Kg of subsidized fertilizer allocated to HH function of farmer/HH characteristics, election outcomes, other factors
Effects of past election outcomes on HH-level subsidized fertilizer targeting

Main empirical model: Unobserved effects Tobit

- Corner solution (11% receive), qty differs, panel data
  \[ \text{fertsub}_{i,t} = \max(0, \alpha + \text{elect}_{k,e,i} \beta + z_{i,t} \delta + c_{i,t} + \mu_{i,t} + u_{i,t}) \]
  \[ D(u_{i,t} | \text{elect}_{k,e,i}, z_{i,t}, c_{i,t}, \mu_{i,t}) = \text{Normal}(0, \sigma_{u}^2) \]
- \text{fertsub}: kg of subsidized fertilizer allocated to HH
- \( i = \text{HH}, t = \text{ag. years} \) (1999/2000, 2002/03, 2006/07)
- \( e_i = \text{last election years} \) (1996, 2001, 2006); \( k = \text{constituency} \)
- \text{elect}: past presidential election outcomes (Banful, 2011)
  - (a) = 1 if ruling party (MMD) won constituency
  - (b) | Percentage point spread MMD – lead opposition |
  - (a) \times (b)

Main empirical model (cont’d)

\[ \text{fertsub}_{i,t} = \max(0, \alpha + \text{elect}_{k,e,i} \beta + z_{i,t} \delta + c_{i,t} + \mu_{i,t} + u_{i,t}) \]
\[ D(u_{i,t} | \text{elect}_{k,e,i}, z_{i,t}, c_{i,t}, \mu_{i,t}) = \text{Normal}(0, \sigma_{u}^2) \]
- \( z \): HH, community, region characteristics – targeting
  - Landholding, assets (farm equipment, livestock)
  - Age, education, sex of HH head; HH members by age group
  - Agro-ecological conditions; distances to nearest town, roads
  - Market price of fertilizer; lagged maize price
- \( c_{i,t} \): unobserved heterogeneity
- \( \mu_{i,t} \): year effects
- \( u_{i,t} \): idiosyncratic error
Effects of past election outcomes on HH-level subsidized fertilizer targeting

Estimation strategy

- Correlated random effects (CRE) Tobit
  - Fixed effects and CRE probit models as robustness checks
- Not concerned about endogeneity of election
  - Constituency level: outcome of 10,000s of votes (150 const.)
  - No feedback (fertsub → elect)

Data

- 3-wave HH-level panel, nationally rep. (12,855 obs.)
- Election results: Electoral Commission of Zambia

Results

Dep. variable: kg of subsidized fertilizer to HH

<table>
<thead>
<tr>
<th>Key explanatory variables</th>
<th>APE</th>
<th>Sig.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) MMD won (=1)</td>
<td>23.2</td>
<td>***</td>
<td>0.00</td>
</tr>
<tr>
<td>(b)</td>
<td>PP spread MMD – lead opp.</td>
<td>-0.1</td>
<td></td>
</tr>
<tr>
<td>Interaction effect: (a) × (b)</td>
<td>0.5</td>
<td>***</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: *** p<0.01, **p<0.05, *p<0.10. APE = average partial effect.

Interaction effect example
- Compare predicted fertsub at 75\(^{th}\) (59 pp) vs. 25\(^{th}\) (19 pp) percentile of MMD margin of victory in 2006
- 33 kg difference

Robustness checks
- FE, CRE probit results similar
- Alternative sets of control variables
Effects of past election outcomes on HH-level subsidized fertilizer targeting

**Discussion**

- **Zambia**: MMD rewards areas w/ strong support
- Similar to **Malawi** findings (Mason & Ricker-Gilbert, 2013)
- Consistent w/ “core supporter/turnout” model

- **Ghana & Kenya**: opposition strongholds targeted (Banful, 2011; Jayne et al., 2013)

- No evidence to date for “swing voter” model for subsidized fertilizer

Do fertilizer subsides win votes in Zambia?

*No! But reducing poverty, inequality, & unemployment does.*
Effects of fertilizer subsidies on district-level share of votes won by the incumbent

Conceptual framework

- **Conventional wisdom in Zambia**: fertilizer subsidies (FRA purchases) effective tools for gaining rural votes
- **Poli. sci. literature on voting in Zambia & SSA** (Bratton et al., 2011; Posner & Simon, 2002)
  - Ethnic voting
  - Economic voting (overall economy)
  - Own economic situation, private goods from government (e.g., subsidized fertilizer, high maize price from FRA)
  - Demographics
- → *Reduced form model of voting behavior* (Cerda & Vergara, 2008)

Main empirical model: Unobserved effects fractional response probit

- Proportion dependent variable, panel data

\[
E(s_{MMD_{d,t}} | ferts_{d,t-1}, F_{RA_{d,t-1}}, v_{p,t}, econ_{p,t}, \mu_{2t}, c_{2d}) = \\
\Phi(\alpha + \beta_1 ferts_{d,t-1} + \beta_2 F_{RA_{d,t-1}} + v_{d,t} \delta_1 + v_{p,t} \delta_2 + econ_{p,t} \gamma + \mu_{2t} + c_{2d})
\]

- **sMMD**: share of votes won by incumbent president
- **d (district)**=1,…,72; **p (province)**=1,…,9; **t** = 2006, 2011
- **ferts**: scale/coverage of fertilizer subsidy program
  - % of smallholder HHs receiving
  - Mean kg/smallholder HH
  - Total district allocation (MT)
Effects of fertilizer subsidies on district-level share of votes won by the incumbent

Main empirical model (cont’d)

\[ E(sMMD_{d,t} | \text{fertsub}_{d,t−1}, FR A_{d,t−1}, v_{d,t}, v_{p,t}, econ_{p,t}, \mu_{2t}, c_{2d}) = \]

\[ \Phi(\alpha + \beta_1 \text{fertsub}_{d,t−1} + \beta_2 F R A_{d,t−1} + v_{d,t}\delta_1 + v_{p,t}\delta_2 + econ_{p,t}\gamma + \mu_{2t} + c_{2d}) \]

- **FRA**: FRA maize purchases (MT)
- \( v_{d,t} \): total population, % female, % in various age groups, registered voters, % female registered voters
- \( v_{p,t} \): % rural, province dummies (ethnicity), prov \( \times \) year
- **econ**: labor force, % unemployed, poverty rate, Gini coefficient (income inequality)
- \( \mu_{2t} \): year effects
- \( c_{2d} \): unobserved heterogeneity

Estimation strategy

- **CRE pooled fractional probit** (Papke & Wooldridge, 2008)
  - Fixed effects models for share & # of votes as robustness checks
- Concerned about **endogeneity** of fertsub, FRA
- **Control function** approach (Rivers & Vuong, 1988; Papke & Wooldridge, 2008)
  - **IVs**:
    - fertsub: % of smallholder HHs w/ landholdings ≥ 1 ha in 2002/03
    - FRA: = 1 if district in main maize-growing agro-ecological regions
    - Strongly partially correlated with endog. variables \( (p<0.001 \text{ for fertsub IVs, } p=0.03 \text{ for FRA IV}) \)
  - Fail to reject exogeneity \( (p>0.74) \)
Effects of fertilizer subsidies on district-level share of votes won by the incumbent

Data
- 2-wave district-level panel (144 obs.)
- Election results: Electoral Commission of Zambia
- Subsidized fertilizer: HH survey data, Min. of Ag.
- Various secondary data sources (GRZ)

Results
Dep. var.: share of district votes won by incumbent

<table>
<thead>
<tr>
<th>Key explanatory variables</th>
<th>APE</th>
<th>Sig.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidized fertilizer variables</td>
<td>Not. sig.</td>
<td></td>
<td>p&gt;0.50</td>
</tr>
<tr>
<td>FRA purchases (‘000 MT)</td>
<td>0.0025</td>
<td>*</td>
<td>0.06</td>
</tr>
<tr>
<td>Unemployment rate (%)</td>
<td>-0.10</td>
<td>***</td>
<td>0.00</td>
</tr>
<tr>
<td>Poverty rate (%)</td>
<td>-0.03</td>
<td>***</td>
<td>0.01</td>
</tr>
<tr>
<td>Income inequality (Gini, 0-100 scale)</td>
<td>-0.02</td>
<td>***</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: *** p<0.01, **p<0.05, *p<0.10. Bootstrapped standard errors (500 replications).
Results (cont’d)
Magnitudes of FRA vs. economic conditions effects

<table>
<thead>
<tr>
<th>% Change from mean</th>
<th>Percentage point change in incumbent’s vote share given a:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>↑ FRA purchases</td>
<td>0.02</td>
</tr>
<tr>
<td>↓ Unemployment</td>
<td>0.5</td>
</tr>
<tr>
<td>↓ Poverty</td>
<td>1.2</td>
</tr>
<tr>
<td>↓ Income inequality</td>
<td>1.3</td>
</tr>
</tbody>
</table>

• **Subsidized fertilizer**: no stat. sig. effect
• **FRA**: stat. sig. effect but magnitude very small
• **Economic variables**: stat. sig. & large in magnitude

Robustness checks: subsidized fertilizer never statistically significant (p > 0.5)

1. **With subsidized fertilizer but WITHOUT poverty, inequality, unemployment**
2. FE models for share and # of votes won by MMD
3. Subsidized fertilizer only (no FRA)
4. Subsidized fertilizer at t-1 and t-2 or just t-2
5. Subsidized fertilizer (district MT), FRA at time t (campaign promises, early distribution/buying)
6. Interact subsidized fertilizer w/ year dummy, provincial dummies, % rural, poverty, FRA
7. Per capita income or consumption expenditure instead of poverty rate
8. Include provincial level variables on ethnicity
9. Different IVs: % of smallholder HHs cultivating 2+ ha (t-1 for subfert, t-2 for FRA)
Why no subsidized fertilizer/FRA effects?

- Relatively few farm HHs benefit
  - 2010/11: ~30% get FISP fertilizer and/or sell to FRA
  - 2006/07: ~10%

- Benefits highly concentrated
  - E.g., 2010/11:
    - 27% of HHs = 55% of FISP, 78% of FRA
    - 3% of HHs = 50% of FRA

Conclusions

1. MMD used subsidized fertilizer to reward loyalty (areas with strong support)

2. Fertilizer subsidies, FRA purchases had no substantive effect on MMD’s share of votes in 2006 & 2011 elections

3. poverty, inequal., & unemploy. wins votes
Policy implications

1. Is politically-motivated subsidy allocation a problem? If so, how to \(\downarrow\) it? e.g., rules-based, transparent, & audited allocations

2. Politicization may be \(\downarrow\) achievement of stated objectives. Could depoliticizing \(\rightarrow\) ‘more bang for the buck’ w.r.t. access to inputs, productivity, food security, incomes?

Policy implications (cont’d)

3. \(\uparrow\)ing effectiveness of subsidies as poverty- & inequality-reduction, employment-creation tools = good politics! (e.g., target the poor, e-voucher to crowd-in private sector/create jobs)

4. >85% ag spending \(\rightarrow\) fertilizer subsidies & FRA. Shifting some funds to investments that \(\downarrow\) poverty, inequality, and/or unemployment = good politics! (e.g., roads, irrigation, electrification, ag R&D, improved extension, health, education, etc.)
Thank you for your attention! Questions?

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