Are There Enduring Benefits of Fertilizer Subsidies on Household Well-Being? Evidence from Malawi

J. Ricker-Gilbert
T.S. Jayne

Department of Agricultural, Food & Resource Economics; Michigan State University

I. Introduction

Conference theme: "Enhancing Agricultural Productivity for Shared Growth in Africa"

When discussing public policies that may promote growth & development, we need to consider:

1. *Opportunity costs:* which policies/programs can achieve the greatest benefit from available scarce public funds?

2. *Growth & Sustainability:* Can the program produce benefits and be sustained over time?

Outline

I. Introduction

II. Objectives

III. Background of subsidy program

IV. Measuring Impacts

V. Methods

VI. Data

VII. Results

VIII. Conclusions & Policy Implications

II.   Objective of this work
To begin quantifying benefits

Measure impacts of fertilizer subsidies on household livelihood

1. How does receiving subsidized fertilizer in a given year affect household well-being in that same year? (CONTEMPORANEOUS EFFECT)

2. How does receiving subsidized fertilizer in past years (or in combinations of past years) affect household well-being in the current year? (DYNAMIC EFFECT)

III. Modalities of Subsidy Distribution key points

1. Fertilizer subsidies are not new, scaled up in Malawi during 2005/06
   - help overcome credit and profitability constraint (Dorward et al. '04)

2. Current wave uses **"Targeted Input Vouchers"**; only available to selected "resource poor" households.
   supposed to overcome inefficiencies of universal subsidies in past
   benefits mainly private input suppliers (Brooks, Dyer and Taylor 2008)

3. Officially, each selected household entitled to two 50kg bags (1 NPK, 1 urea); Recently 2kg bag of seed for free

4. Both rate of subsidy & fertilizer market price increasing over time
   - 64% subsidy in 2005/06;   90% subsidy in 2008/09
   - Market price: $0.23/kg in 2005/06; $1.00/kg in 2008/09
   - 5.6% of nat. budget in 2005/06;   16% in 2008/09

III. Modalities of Subsidy Distribution
key points (continued)

5. Coupons for subsidy distributed at regional level based on area under cultivation.

6. Methods for local coupon allocation had the potential to vary across villages.
   - Village leaders & distribution committee, open forums.
   - Supposed to go to people who could contribute to national level production but could not afford 1-2 50 kg bags of fertilizer at commercial prices

   Evaluation Standpoint: Due to non-random distribution we need to understand how people were targeted.

IV. Impacts Measured

We measure how providing subsidized fertilizer to farm households over a period of time affects the following;

1) Total area planted by the household (maize, tobacco, other)

2) Household production of crops (maize, tobacco, other)

3) Rainy-season crop income (value of crops harvested – costs)
    primary season when subsidy is distributed

4) Off-farm and total household income
    Measure spill-over effects and tradeoffs

(Note: These are the dependent variables used in the analyses)

V. Methods
household (i) at time (t)

$$\text{Well-being}_{it} = \alpha + \beta_0 \text{subfert}_{it} + \beta_1 \text{subfert}_{it-1} + \beta_2 \text{subfert}_{it-2} + \beta_3 \text{subfert}_{it-3} + \textbf{HH\_factors}_{it}\boldsymbol{\delta_j} + \textbf{Prices}_{it}\boldsymbol{\sigma_j} + \textbf{rainfall}_{it}\boldsymbol{\rho_j} + \text{error}_{it}$$

Contemporaneous effect = β_0 ; **Dynamic effect =** $\beta_1 + \beta_2 + \beta_3$

Problem: Subfert$_{it}$ may be correlated with error.
     need to control this issue to make case for causal effect

Controlling correlation between Subfert$_{it}$ and error term
- first-difference
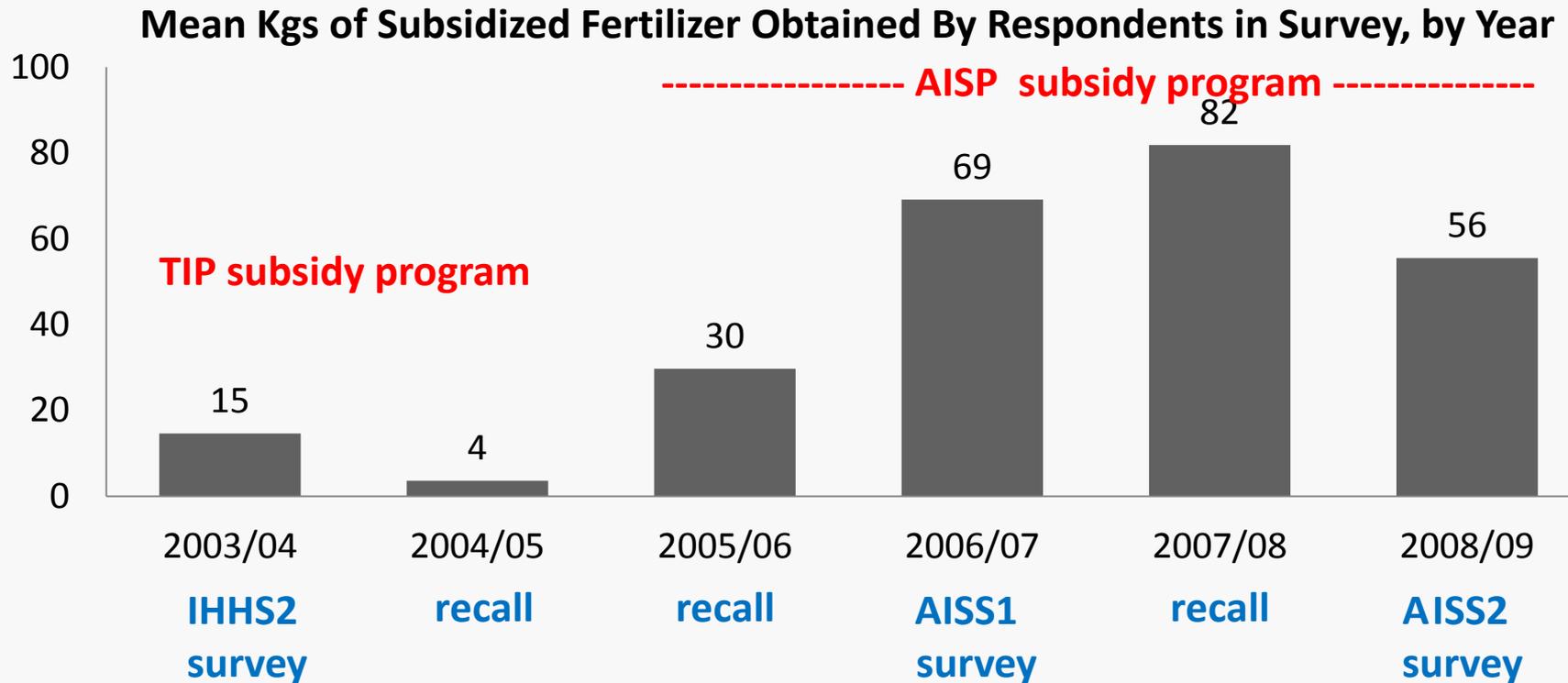- instrumental variable methods

V. Methods
Subsidized fertilizer acquisition

Subfert$_{it}$ = same variables as in previous model

+ ρ$_j$MP_in_village$_{it}$ + error

- Control Function Method

    - Controls for the non random distribution of the subsidy

    - Allows us to understand factors affecting receipt of subsidy

IV. Data

Mean Kgs of Subsidized Fertilizer Obtained By Respondents in Survey, by Year

----------------- AISP subsidy program ---------------

TIP subsidy program

Year	Value	Survey
2003/04	15	IHHS2 survey
2004/05	4	recall
2005/06	30	recall
2006/07	69	AISS1 survey
2007/08	82	recall
2008/09	56	AISS2 survey

- 1,375 respondents; can trace fertilizer use for 6 years.
- Have production, income and household information during 3 survey years.

- If we want longer-run effect, we can use the two most recent surveys.
  - ultimately have two waves of prod, inc. & HH data
  - with 4 years of subsidized fertilizer use data.

10

V. Results
Who got the subsidy?

Estimated change in kgs of subsidized fertilizer received during the current year

	Coef.	P-val
If Member of parliament resides in community	**9.0**	**(0.00)**
Effect of getting subsidy in three previous years	**- 1.1**	**(0.00)**
Area cultivated by household	**4.5**	**(0.01)**
Note: Avg. qty received by HH	62 kgs	

Note: Red denotes statistical significance at 10% level;

Evidence that female headed households and poorer households did not get significantly more subsidized fertilizer.

V. Results

How does subsidized fertilizer affect crop production?

Estimated change in maize production given 1 kg increase in subsidized fertilizer.

	Maize Kg Change	Tobacco kg Change (percent)	Other Crop kg Change (percent)
	Coef. P-val.	Coef. P-val.	Coef. P-val.
Contemporaneous effect	2.45 (0.00)	1.1% (0.02)	0.2% (0.00)
Dynamic effect	1.59 (0.03)	8.9% (0.36)	-0.26% (0.63)
Note: Mean HH production	420 kgs	55 kgs	Fisher qty index

Note: Red denotes statistical significance at 10% level;

V. Results

How does subsidized fertilizer affect income?

Estimated change in income given 1 kg increase in subsidized fertilizer.

	Rainy season income (US $) Coef. P-val.	Off-farm income (US $) Coef. P-val.	Total HH income (US $) Coef. P-val.
Contemporaneous effect	**$1.50 (0.00)**	**- $0.63 (0.35)**	**$1.01 (0.17)**
Dynamic effect	**$0.55 (0.52)**	**$0.58 (0.47)**	**1.42 (0.24)**
Note: Mean HH income	$130	$137	$313

Note: Red denotes statistical significance at 10% level;
Total HH income=rainy season income + dry-season income + animal income + ag. labor income + off-farm income

VI. Conclusions & Policy Implications

The goal of this study:
 1) to estimate impacts of the fert. subsidy program in Malawi on key indicators of household well-being
 2) take a step towards addressing program impacts over time.

Key Findings: Contemporaneous effect of receiving one kg of subsidized fertilizer in that year
 1) Maize production: response of 2.45 kgs of maize
 2) Rainy-season crop income: increase of US $1.50
 3) no increase in off-farm or total income

Key Findings: Dynamic effect of receiving one kg subsidized fertilizer in the previous 3 years
 1) increase in maize production: response of 1.59 kgs. of maize
 3) no increase in rainy-season crop income or total income

Key Findings: Targeting
 1) Political capital affects receipt
 2) People with more land get more
 3) Female headed and poor did not get significantly more

14

VI. Conclusions & Policy Implications

Implications

1) Evidence of some contemporaneous farm-level benefits (income & maize prod & tobacco prod)

2) Main dynamic effects on maize prod (1.59 kg maize : kg fert)
   - maybe some build up of P or organic matter in soil
   - maybe some learning or adaptation over time
   - some of the increase from area expansion: (land constraints?)

3) Why dynamic effects on maize prod but not crop income?
   - could be some resource re-allocation (labor & planting)
   - variability in income from year to year (input & output price)

4) This study focuses on the direct benefit side to recipients
   - may be some spill-over benefits (ag wage, nutrition, milling)
   - costs to consider (to farmer, gov't, priv. sector, opportunity cost)

5) Improving issues with targeting can increase program efficiency.

VI. Conclusions & Policy Implications

Implications

This study is an impact assessment, not a formal cost-benefit analysis

2005/06 to 2008/09: Benefit/Cost ratio for subsidy program in Malawi Range: 1.90 to 0.72 (Dorward, Chirwa & Jayne 2010)

Consider Rainy-Season Income Effects (Our Study)

US $1.50 per kg subsidy in current year

Consider Fertilizer Cost in Malawi

To farmer: $0.13/kg in 2006/07; $0.10/kg in 2008/09

Full cost: $0.33/kg in 2006/07; $1.00/kg in 2008/09

Consider Displacement Rate & Administrative Costs:

Possible that benefits to farmers likely high

Possible that benefits to social welfare may not be as high

VI. Conclusions & Policy Implications

So what other investments could work?

Returns in Ag Growth to Investments & Subsidies in India, 1960-2000

Returns to Ag. GDP	1960's		1970's		1980's		1990's	
Rup. prod/Rup. spent	Return	rank	Return	rank	Return	rank	Return	rank
Road investment	8.79	1	3.80	3	3.03	5	3.17	5
Education investment	5.97	2	7.88	1	3.88	3	1.53	3
Irrigation investment	2.65	5	2.10	5	3.61	4	1.41	4
Irrigation subsidies	2.24	7	1.22	7	2.28	6	NA	6
Fertilizer subsidies	**2.41**	**6**	**3.03**	**4**	**0.88**	**8**	**0.53**	**8**
Power subsidies	1.18	8	0.95	8	1.66	7	0.58	7
Credit subsidies	3.86	3	1.68	6	5.20	2	0.89	2
Agriculture R&D	3.12	4	5.90	2	6.95	1	6.93	1

Source: Fan et al. 2007

Worth using panel data or other methods to evaluate

1) effectiveness of other possible programs/investment in Africa

2) potential spill-over benefits of fert. subsidy (nutrition, wages, milling)

Thank you for your time!

rickergi@msu.edu

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