The Impact of State Marketing Board Operations on Smallholder Behavior and Incomes: The Case of Kenya

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Outline

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Motivation

- Return / resurgence of state-owned grain marketing boards, strategic grain reserves, state-led fertilizer subsidy programs in East and Southern Africa (ESA)
  - Due to world food price crisis of 2007-2008
  - Shift to unconditional budget support from some donors to governments in ESA
  - Often justified by need to reduce staple food prices by stimulating domestic food production
  - Yet little empirical evidence on effect of marketing boards on smallholder behavior & welfare?

Motivation

- Existing literature on marketing board impacts on farmer behavior/welfare
  - Largely from 1980s / 1990s
  - Primarily based on national-level market or price data
  - Few studies use recent or household-level data
  - Recent exceptions (Kutengule, Nucifora, and Zaman 2006; Mason 2011)

Objectives: Case of Kenya

Using rural household data 1997-2007, we measure:

1) Effect of Kenya's National Cereals Marketing Board (NCPB) activities in Kenyan maize market on smallholders' farm-gate maize price expectations
2) Sensitivity of smallholder factor demand & crop output supply to maize prices
   - Determine effect of NCPB on smallholder behavior
   - Determine if effects vary by agro-ecological zone, HH landholding, demographics

Data Sources

1) Rural household panel survey data
   - Collected by Tegemeo Institute / MSU
   - Ag years 1996/7, 1999/0, 2003/4, 2006/7
   - 8 main crop-oriented provinces, 8 agro-ecological zones
   - N=1,575 households in 1997; n=1,342 households in 2007 (85% re-interview rate)
   - We use n=1,115 households per year
2) Data on district-level NCPB maize purchase & sale volumes, NCPB maize purchase prices

Data Sources (2)

3) Village-level satellite-based estimates of main season rainfall (NOAA, FEWS)

Background: NCPB role in maize marketing in Kenya

- Maize is main staple food & most common food crop grown by smallholders
- From early 1930s to late 1980s, Kenya's maize marketing system was tightly controlled
  - National Cereals Produce Board (NCPB) had monopoly on internal & external maize trade

Background: NCPB role in maize marketing in Kenya (2)

- Gradual market liberalization began in late 1980s, under pressure from international lenders
  - NCPB's share of total marketed maize declined over time, yet it was never fully dismantled
  - Average NCPB purchase volume share was 8% from 1995-2008; has increased to 25-35% in recent years

Background: NCPB role in maize marketing in Kenya (3)

- Stated goals of NCPB activities:
  - Support maize prices → stimulate domestic maize production → lower maize prices for consumers
  - Reduce maize price variability
- NCPB activities have met some of these goals (as measured by wholesale maize prices):
  - Between 1995-2004, NCPB increased average wholesale maize prices by 20% and reduced their variability (Jayne, Myers, Nyoro, 2008)

Methods: Modeling Farm-gate Maize Price Expectations

1) Post-harvest prices for maize & other crops (paid by traders or NCPB) not known to farmers at planting
   - We model smallholder farm-gate maize price expectations as function of prices & other factors observed by smallholders at planting
   - Similar to quasi-rational expectations (Nerlove & Fornari, 2008)

Methods: Modeling Farm-gate Maize Price Expectations (2)

2) Use a single-channel approach (smallholders sell to private traders only)
   - Private sector grain traders in Kenya have operated alongside NCPB with no movement fees or restrictions since 1995
   - Less than 2% smallholders in our survey data sold directly to NCPB (they buy almost exclusively from large-scale farmers)

Methods: Modeling Farm-gate Maize Price Expectations (3)

3) NCPB purchase prices & volumes may still affect smallholder farm-gate price expectations:
   - Via smallholder's expectation of NCPB purchase prices & volumes for that season
   - Via wholesale prices observed at/before planting (Jayne, Myers, and Nyoro, 2008)

Methods: Modeling Farm-gate Maize Price Expectations (4)

- Dependent Variable = ln(household sale price of maize)
- Explanatory variables:
  - Ln(effective NCPB expected purchase price)
  - Ln(12 lagged regional wholesale prices, beginning with planting month)
  - District-level NCPB purchase volume (t-1)
  - Distance to regional wholesale market
  - Distance to nearest motorable road
  - HH characteristics: total landholding, head's education, bicycle/cart ownership, etc
- Estimation by OLS

Methods: Modeling Output Supply (maize)

- Specification derived from utility maximization assumptions
- Dependent Variables:
  - Ln(HH maize production) estimated via OLS with household FE
  - HH area planted to maize (ha)
    - Intensive and less-intensive maize (2 Tobits)
- Explanatory Variables:
  - Agro-ecological factors
    - Agro-ecological zone & year dummies
    - Rainfall in main season (expected for area)
    - Drought shock in main season (expected for area)

Methods: Modeling Output Supply (maize) (2)

- Explanatory variables
  - Prices (in natural logs) & market access
    - Expected farmgate maize price (from 1st stage)
    - Village price of DAP fertilizer
    - Village ag wage
    - Expected prices of competing crops (t-1)
    - Distance to nearest motorable road
  - Household factors of production, demographics
    - Ln(Total landholding)
    - # of adults age 15-59
    - Ln(Total value of farm equipment & livestock)
    - Head's age
    - Head's education
    - 1=single female head

Methods: Modeling Factor Demand (fertilizer used on maize)

- Specification derived from utility maximization assumptions
- Dependent Variable (corner solution, double hurdle model):
  - 1=HH applied fertilizer to maize
  - Ln(Quantity of fertilizer applied to maize) (kg/ha)
- Explanatory Variables:
  - Same as for output supply (maize area), plus:
    - Distance to fertilizer seller
    - Village-level dummies for soil type

Methods: Modeling Output Supply & Factor Demand (other crops)

- Changes in maize production & input use may affect input use and output of alternative crops
- Output supply by crop group (Dependent variable = area planted, Fisher-Ideal index)
  - Bean/cowpea
  - Root crops
  - Vegetables (kale, onions, tomatoes)
  - Perennials (coffee, avocado, mango)
  - Short perennials (banana, sugarcane)
  - Total crop production (maize + these crops)

Methods: Modeling Output Supply & Factor Demand (other crops)

- Factor demand
  - Total fertilizer use (kg/ha)
- Total net crop income

- Estimate of total crop output, total net crop income
  - OLS with household FE
- Estimation of Other crop groups, total fertilizer use
  - Tobit with CRE

Results: NCPB effects on expected farm-gate maize prices

- Significant positive effect of effective NCPB purchase price
  - 10% increase in effective NCPB purchase price → 1.4% increase in expected farmgate maize sale price
- Jointly significant positive effect of 12 months of lagged wholesale prices
  - A 1% joint increase in wholesale maize prices → 0.25% increase in expected farmgate price
- No significant effect of district-level NCPB purchase volumes

Results: Output supply (maize)

- Effect of 1% increase in expected (farm-gate) maize price →
  - 2.1% increase in household maize production
  - Implies that a 10% increase in NCPB purchase price → 1.37% increase in expected farm-gate maize price → 2.9% increase in household maize production
- Effect of 1% increase in expected maize price →
  - No significant effect on total maize area
  - 0.29 ha increase in intensive maize area
  - 0.26 ha decrease in less-intensive maize area

Results: Factor demand (fertilizer use)

- Effect of 1% increase in expected maize price →
  - 0.5% increase in probability of fertilizer use on maize
  - 1.2% increase in quantity applied (current users), 2.4% increase (any household)
  - Suggests that household increases in maize production driven by intensification (increased fertilizer use + higher seeding rate)
  - Nearly significant positive effect on probability of using fertilizer on any crop (p=0.15)

Results: Output supply (other crops, total crop income)

- A 1% increase in expected maize price →
  - No effect on total area cultivated
  - No reduction in area planted to other crop groups
  - Increase in bean/cowpea production (often intercropped with maize) and total crop production
  - Increase in total net crop income by 1.9%
    - Not too surprising given that maize grown by 99% of smallholders and is main food staple crop

Summary & Policy Implications

- NCPB activities raise the expected farm-gate maize prices of smallholders, who increase their maize production via intensification
  - NCPB achieving goal of providing incentive for increased domestic maize production.. but what are implications for societal welfare?
- Kenyan consumers would be better off with lower maize prices
  - In recent years, maize prices in Kenya at or above IPP
    - NCPB activities + 50% tariff on imported maize

Policy Implications (2)

- Recent study predicts that higher maize prices lead to increased poverty headcounts in every region except High Potential Zone (Mghenyi, Myers, Jayne, 2011)
  - 60% of rural households are net maize buyers (i.e. hurt by higher maize prices)
  - Most of net maize sellers are in high potential zone
- NCPB & maize trade policies appear to transfer income from urban HHs & rural net maize buyers to net sellers

Policy Implications (3)

- Further research:
  - Assess welfare benefit of reduced maize price variability via NCPB activities
  - Cost/benefit assessment of NCPB activities
  - Assess whether marketing boards in other countries are having similar production and welfare effects