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PROMOTING AGRICULTURAL TRADE TO ENHANCE RESILIENCE

# Volatility and resilience in African food markets

Nicholas Minot

Based on ATOR chapter with Lauren Deason, David Laborde, Shahidur Rashid, & Maximo Torero

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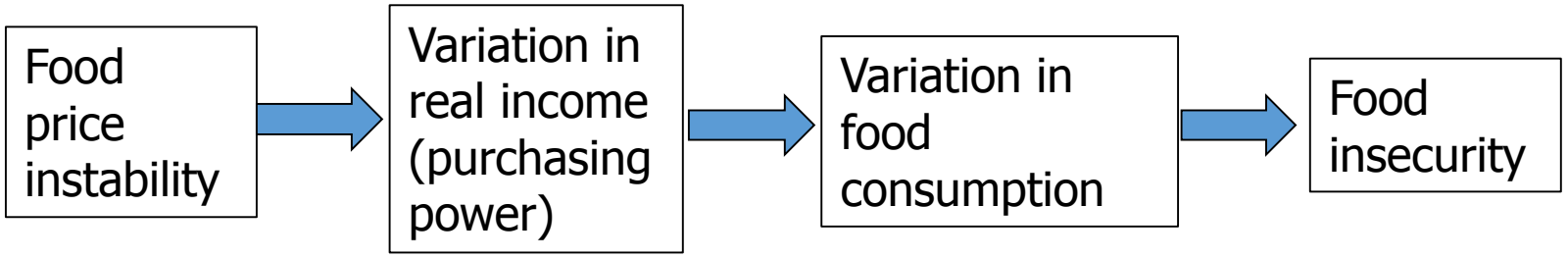
# Outline

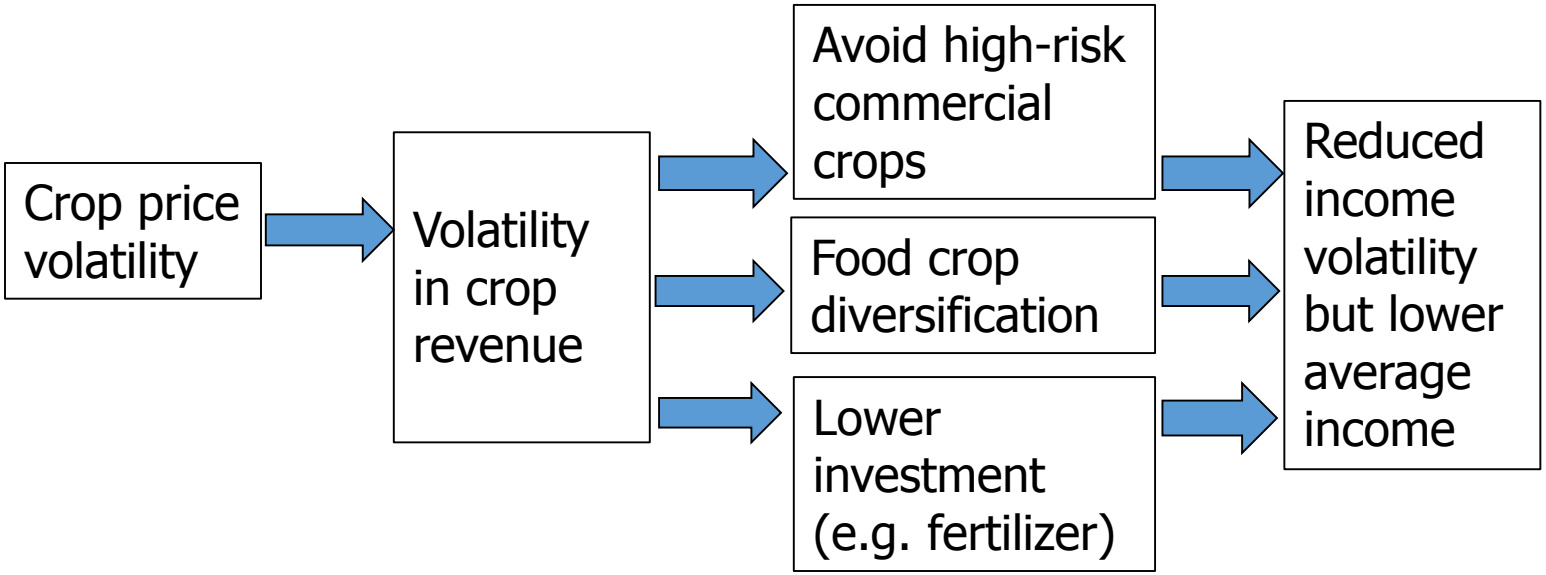
- Effects of food price volatility
  - Why do we care?
- Causes of food price volatility
  - Solutions depend on the causes
- Reducing food price volatility
  - Price stabilization and other methods
- Reducing the impact of food price volatility
  - Particularly for vulnerable households
- Conclusions and implications

# Effect of food price volatility on consumers




- Effect of food price instability on consumers depends on
  - Importance of food in consumption
  - Ability of household to smooth consumption with savings, credit, & assets
  - Level of income
  - Degree of risk aversion

# Effect of food price volatility on farmers




- Effect of food price instability on farmers depends on
  - Importance of crop as source of income
  - Negative correlation between farm output and prices
  - Degree of risk aversion
  - Ability to smooth income volatility with savings, credit, & assets

# Causes of food price instability (1)

- Seasonal variation in domestic supply of commodity
  - More seasonality in price for perishable crops (e.g. fruits & vegetables) than for storable commodities (e.g. grains)
  - More seasonality in price if uni-modal rainfall and rainfed production
  - Based on an analysis of 280 prices in Sub-Saharan Africa
    - Maize, sorghum, and millet are more seasonal
    - Rice and wheat are less seasonal, probably because of international trade: imports dampen price spikes

| Commodity | Number of price series | Seasonal price index |
|---|---|---|
| Maize | 94 | 0.32 |
| Sorghum | 69 | 0.27 |
| Millet | 49 | 0.24 |
| Rice | 58 | 0.15 |
| Wheat | 10 | 0.17 |

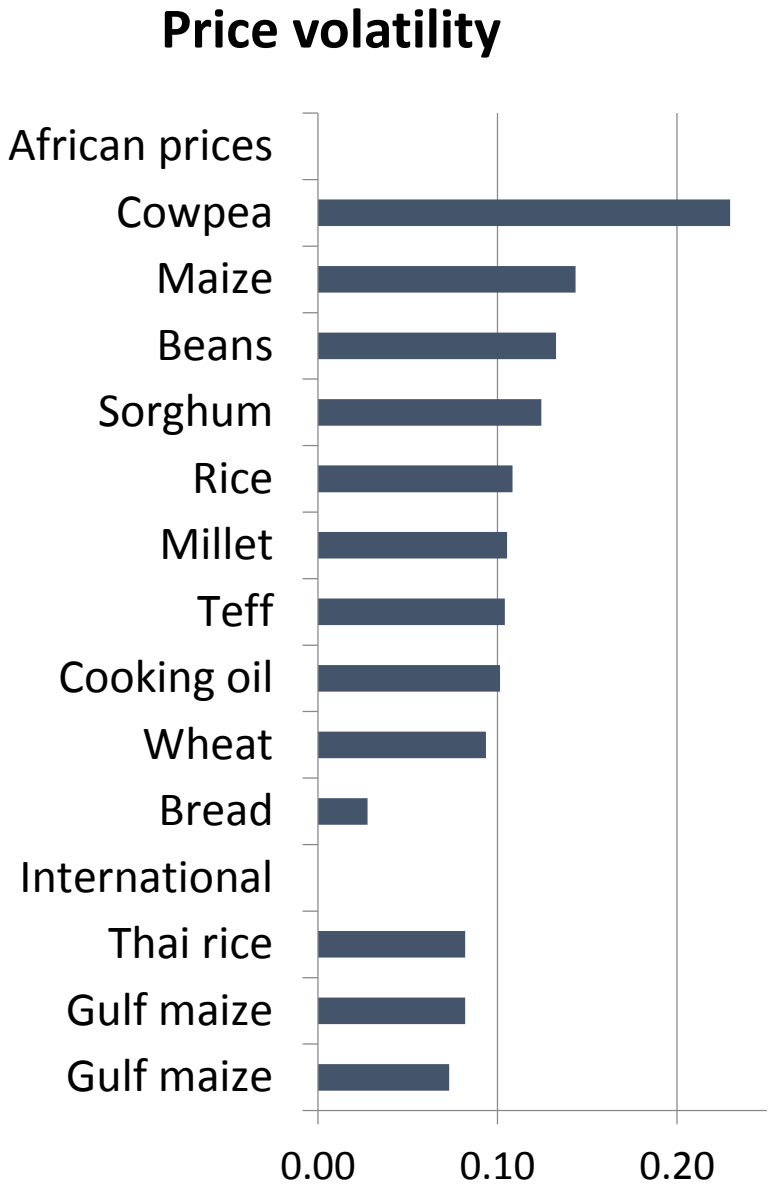
# Causes of food price instability (2)

- Annual variation in domestic supply of commodity
  - Size of harvest has large impact on food prices
  - More volatile prices if:
    - Crop is rainfed and rainfall is unpredictable
    - Crop is not drought resistant
    - Marketed surplus of crop comes from a small area
    - Cross-border and international trade is limited
  - Grain production is more variable in Africa than Asia
    - CV of rice output in Asian countries is 2-10%

| Crop | Country | CV of output |
|---|---|---|
| Maize | Ethiopia | 18% |
| | Kenya | 13% |
| | Malawi | 24% |
| | Zambia | 39% |
| | S. Africa | 23% |
| | SSA average | 31% |
| Rice | Madagascar | 12% |
| | C d'Ivoire | 33% |
| Cassava | Nigeria | 9% |
| | Mozambique | 23% |
| | Tanzania | 13% |
| | SSA average | 21% |
| Wheat | Ethiopia | 15% |
| | Kenya | 21% |

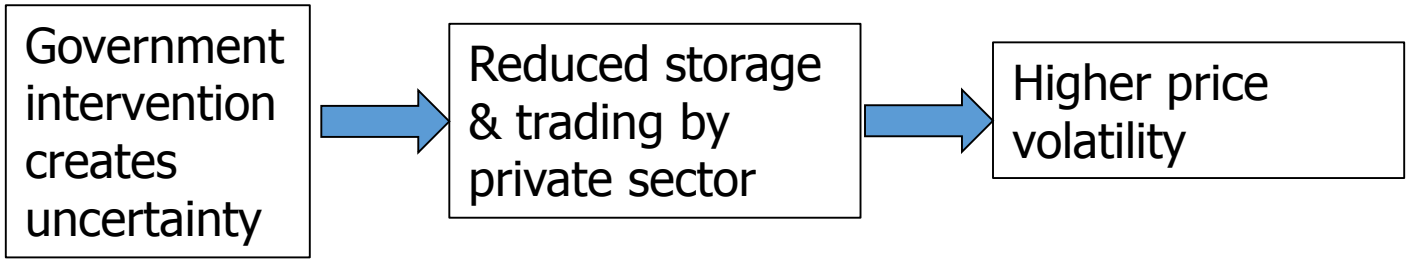
# Causes of food price instability (3)

- Fluctuations in world prices
  - Food crisis of 2007-2008 dramatized link between local and world markets
  - Wheat and rice are more closely linked to world markets than other staple grains
  - However, world prices are not a major source of volatility in most African markets:
    1. World grain prices are less volatile than African grain prices
    2. Analysis of price transmission shows that only 10% of maize prices are statistically linked to international maize prices
    3. Price volatility of tradable grains (wheat and rice) is less than for non-tradable grains



# Causes of food price instability (4)

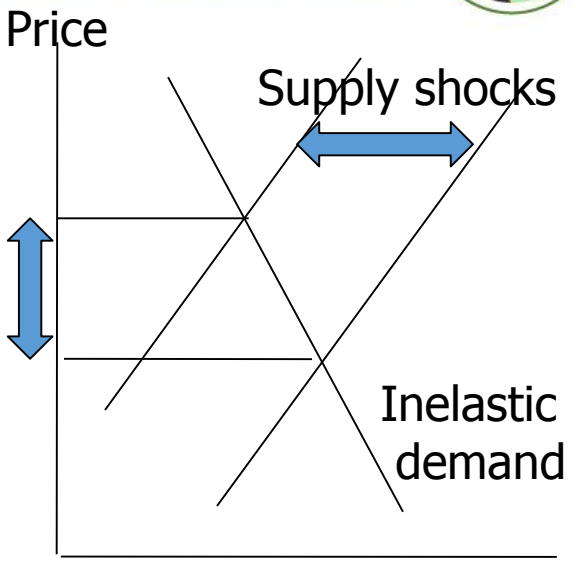
- Policy shocks
  - Large and unpredictable interventions in food markets can exacerbate price volatility. Why?

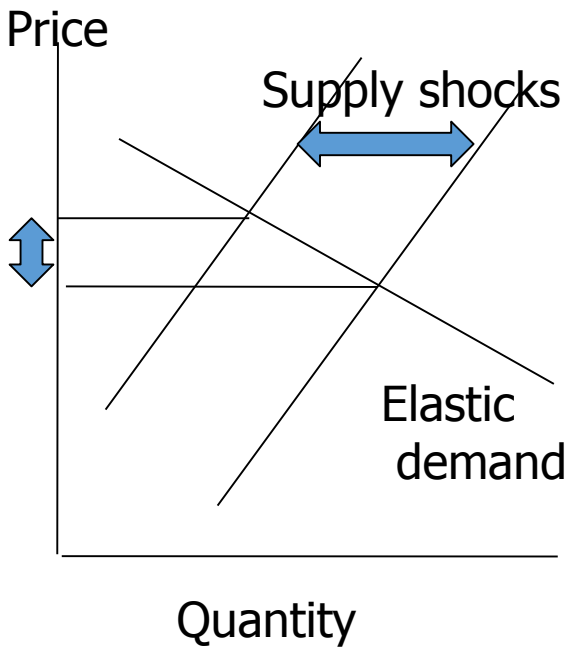



  - Maize price spikes documented in several countries caused by:
    - Overly optimistic estimates of harvest
    - Excessive government purchases
    - Government-to-government contracts to export maize
    - Expectation of government imports which inhibits private imports but is later delayed due to budget or logistical problems
    - Lack of information about size of government stocks, leading to unexpected stock-out

# Causes of food price instability (5)

- Other factors
  - **Inelastic demand**: A supply shock will cause larger spike in prices if demand is inelastic. Demand for staple foods is usually inelastic (see graphs).
  - **Level of grain stocks**: Small stocks associated with greater volatility. Large stocks can be used to smooth supply and reduce volatility.
  - **Volatility in related markets**: Price fluctuations in fuel or maize markets may affect sorghum prices



# Reducing food price volatility – Price stabilization

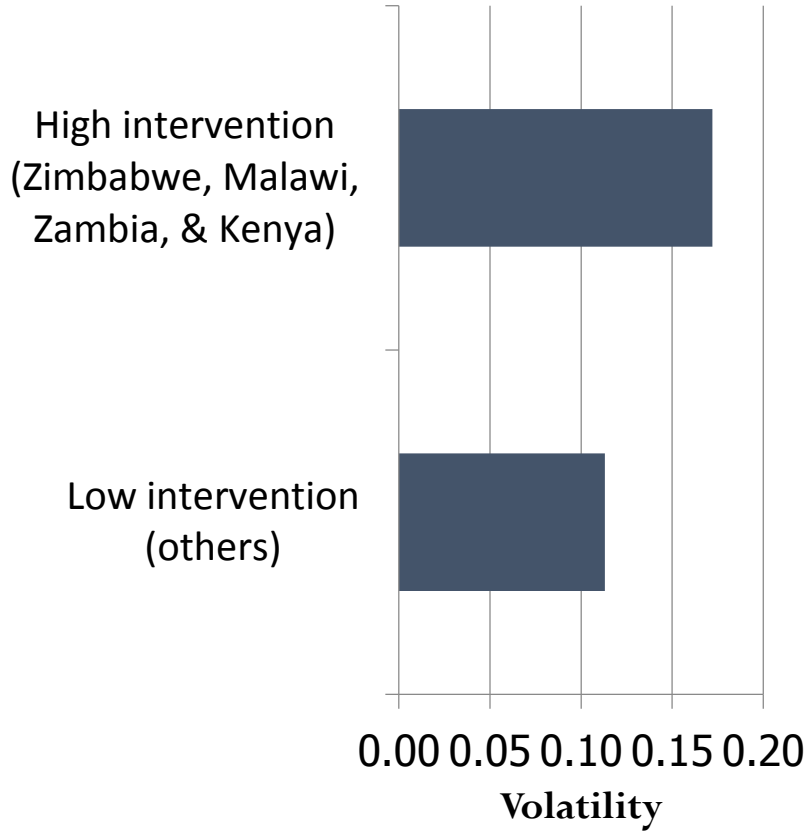
- In theory
  - Buy commodity when price falls below floor price
  - Sell commodity when price goes above ceiling price
  - Stabilizes price and makes a profit!
- In practice
  - Buying & selling is ad hoc, contributes to uncertainty
  - Difficult to set prices
    - Too low→Exhaust stocks; Too high→Accumulate stocks
  - Price stabilization is expensive
    - Large procurement costs (US$ 80 m in Zambia in 2010)
    - High storage, handling, and overhead costs
    - State enterprises cannot cover costs with stabilization efforts
  - Aggregate benefits are small
    - Most estimates 0-4% of farm income
  - Benefits of price stabilization not pro-poor
    - Most of benefits to larger commercial farmers, also urban poor
  - Food price stabilization prone to “rent-seeking”

# Reducing food price volatility – Price stabilization

Do price stabilization efforts actually stabilize prices?

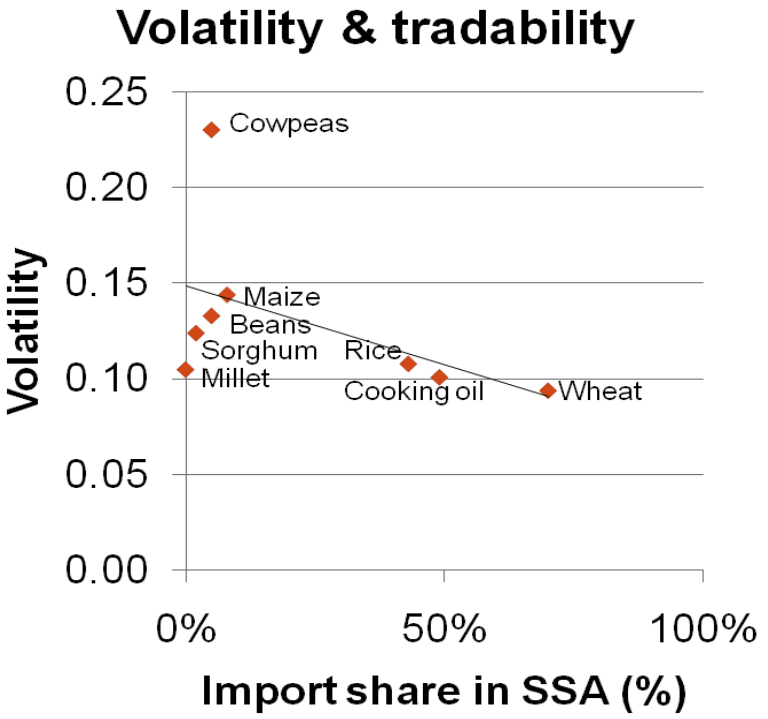
- High intervention countries
  - Zimbabwe – GMB had monopoly on maize mkting 2002-2010
  - Malawi – ADMARC involved in domestic trade and exports
  - Zambia – FRA active in domestic and international maize
  - Kenya – NCPB attempts to stabilize price and imports
- Low intervention countries
  - Uganda & Mozambique have little or no public stocks of grain
  - Ethiopia & Tanzania have emergency reserves but too small to stabilize prices
- Other factors: dependence on maize

**Maize price volatility & market intervention**



# Reducing food price volatility – Other policies

- International trade
  - World grain prices less volatile than African grain prices
  - Local prices of traded commodities less volatile than prices of non-traded commodities (see graph)
  - International trade sets upper & lower limit on local prices (import and export parity price) *if trade is allowed*
  - Examples of maize price spikes above import parity due to trade restrictions
    - Kenya – import permits
    - Ethiopia – foreign exchange rationing
    - Malawi – planned government imports that were delayed
    - Zambia – import restrictions



# Reducing food price volatility – Other policies

- Reducing transportation costs
  - Lower transport cost to port → narrower band between upper & lower limit
  - Geographically large markets reduce supply volatility

**Price volatility by type of city**

| Location | Maize | Rice | Sorghum |
|---|---|---|---|
| Largest city | 0.098 | 0.071 | 0.116 |
| Other cities | 0.151 | 0.116 | 0.126 |

- Improved information about grain markets
  - Use of mobile phones can improve market information
  - Akers (2010) study of Niger found expansion of mobile signals → lower dispersion of prices
  - Better information on harvest (crop forecast) and stocks

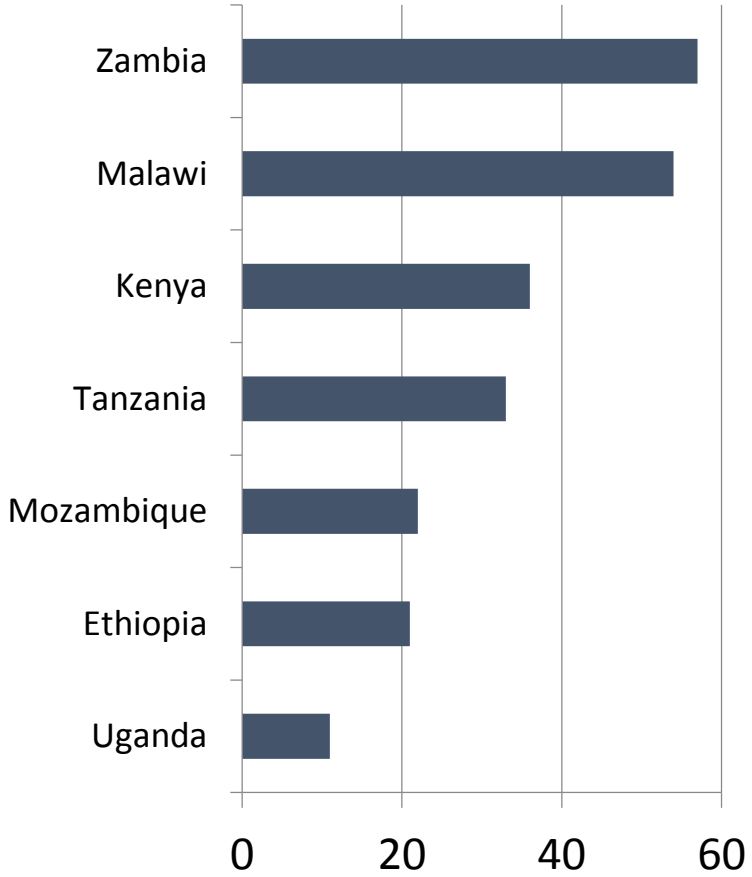
# Reducing food price volatility – Other policies

- Promote grain storage by farmers & traders
  - Enabling environment
  - Promote construction of warehouses & rental of public facilities
  - Could reduce seasonal price volatility
- Using futures & options markets to "lock in" import price
  - SAFEX market for southern Africa
  - Malawi used SAFEX options market in 2005-6
  - Eliminates risk of high import prices but..
    - Cost 8-10% of the value of imports
    - Somewhat complicated to negotiate and execute
- Establishment of local commodity exchanges
  - In theory, makes market more transparent
  - In practice, African commodity exchanges have not yet achieved significant volumes in food grains
  - Need complementary institutions such as grades & standards and warehouse receipt systems

# Reducing *impact* of food price volatility

- Diversification of diet
  - Promotion of secondary staples, particularly drought-resistant crops such as sorghum, millet, and cassava
  - Zambia and Malawi have highest dietary dependence on maize
- Safety net programs
  - Focus efforts on directly assisting poor households rather than indirectly helping poor by influencing prices
  - Many successful examples in Latin America (e.g. Progresa in Mexico and Bolsa Familia in Brazil)
  - Productive Social Safety Net (PSNP) in Ethiopia has been successful in distributing food and cash to needy households

**Importance of maize in diet (% calories)**



# Conclusions

- Effects
  - Food price volatility mainly hurts large farmers and poor urban consumers, particularly if dependent on one commodity
- Causes
  - Food price volatility higher in African than on world markets
  - Volatility higher for non-tradables (such as maize) than tradables (such as wheat and rice)
  - Rice and wheat price linked to world markets, so volatility caused by world prices & local supply shocks
  - Volatility in maize & other staples due mainly to local supply shocks
  - Effects exacerbated by inelastic demand, policy uncertainty, trade restrictions, and high cost of transportation

# Conclusions

- Policies to reduce food price volatility
  - Food price stabilization
    - Malawi, Zambia, & Kenya use public reserves and trade policy to stabilize prices
    - Intervention is ad hoc rather than rules-based
    - Can be very costly
    - Main beneficiaries are large commercial farmers
    - Prone to “rent-seeking” behavior
    - Most African countries have only modest or no price stabilization efforts (e.g. Uganda, Mozambique, Tanzania, & Ethiopia)
  - International trade can set upper and lower limit on local prices
  - Lower transportation costs broadens market, reduces volatility
  - Better information about harvest, stocks, and prices
  - Promoting storage by farmers and traders would reduce seasonality
- Policies to reduce *impact* of food price stability
  - Diversification of diets away from maize to make demand more elastic
  - Safety net programs to target assistance on vulnerable households

# Implications

- Price stabilization
  - If politically necessary, cost and distortion can be minimized by adopting rules-based intervention and wide band between buying and selling price
- Facilitate domestic, cross-border, and international trade
  - Wider markets link surplus and deficit areas, reducing volatility and price dispersion
- Make food markets more transparent
  - Need better info about size of harvest, grain stocks, and level of prices
  - Use mobile phone technology to promote market information
- Explore options for promoting grain storage by farmers & traders
  - Requires signals from government of approval, as well as technology and access to government warehouses
- Diversify diets away from maize
- Establish & strengthen safety net programs

Thank you!

Comments and suggestions welcome.

# Extra slides: Data

Sources of price data

- IMF for world price of maize, rice, and wheat
- FEWS-NET for food prices in sub-Saharan Africa
  - For patterns, 167 food prices covering Jan 2005-Mar 2011
  - For trends, 67 food prices covering Jan 2003-Dec 2010
  - 82% are retail prices, others are wholesale & assembler
  - Used nominal prices, though sensitivity analysis indicates virtually identical results from using US$

# Methods

- Measuring volatility
  - Standard definition is the standard deviation in "returns" (percentage changes in price from one period to next)

$$\text{Volatility} = \text{stdev}(r) = \left[\sum \frac{1}{N-1}(r_t - \bar{r})^2\right]^{0.5}$$

where $r_t = \ln(p_t) - \ln(p_{t-1})$

$$\bar{r} = \sum \frac{1}{N} r_t$$

- Why not use coefficient of variation of prices (σ/μ)?
  - Non-stationarity of prices implies that standard deviation of price (and therefore CV) increases with sample size
  - Standard measure of volatility is stationary if prices follow a random walk with multiplicative errors

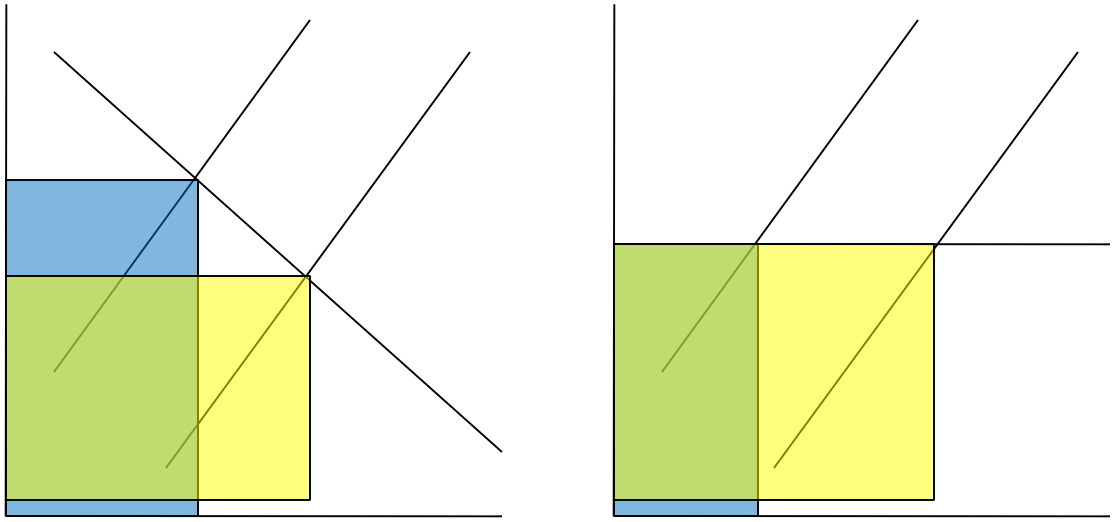
# Reasons for interest in volatility

| Household type | Impact of food price volatility | Explanation | Estimated benefits of stabilization (% of income) | | | |
|---|---|---|---|---|---|---|
| | | | Newberry & Stiglitz | Islam & Thomas | Myers | Bellemere et al |
| Low-income urban | High | Food purchases are large share of budget (60-70%) | 0-3% for all house-holds | | 1% | |
| High-income urban | Low | Food purchases are small share of budget (20-40%) | | | 0% | |
| Large commercial farms | Medium to high | Food crop sales may be large share of income | | 1.5-3.5% for farm house-holds | 9% | 0-2% for each food crop, 13% for coffee, most gains to large farmers |
| Small semi-subsistence farms | Low to medium | Net food sales are small (positive or negative) as share of income | | | 3% | |

# Food price instability – Effects on households

- For farmers, price stabilization may actually *destabilize* income

**No price stabilization**
In bad year, high price offsets low output; in good year, low price but high output



**With price stabilization**
Variation in output not offset by changes in price. More income instability.