Food price stabilization:
Concepts and exercises

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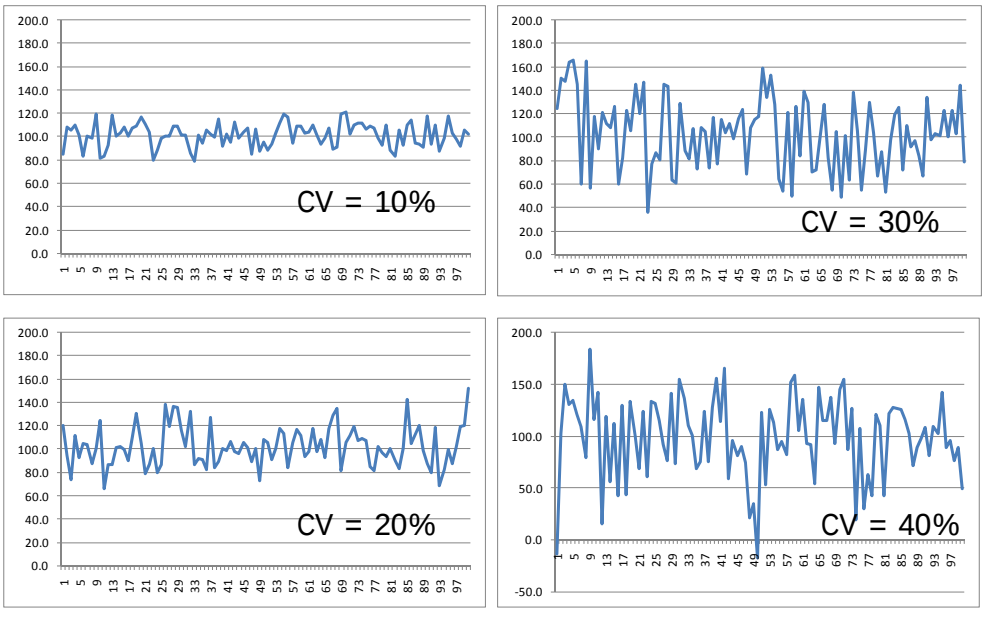
Outline

- Food price instability
  - How is price instability measured?
  - How do we simulate price instability in Excel?
- Explanation of price stabilization model
- Sources of price instability
- Price instability and income instability
- Effect of trade on food price stability
  - Import and export parity prices
  - How does trade stabilize prices?
- Role of buffer stocks in stabilizing food prices
  - Price band, buying and selling price
  - Width of price band
  - Level of price band

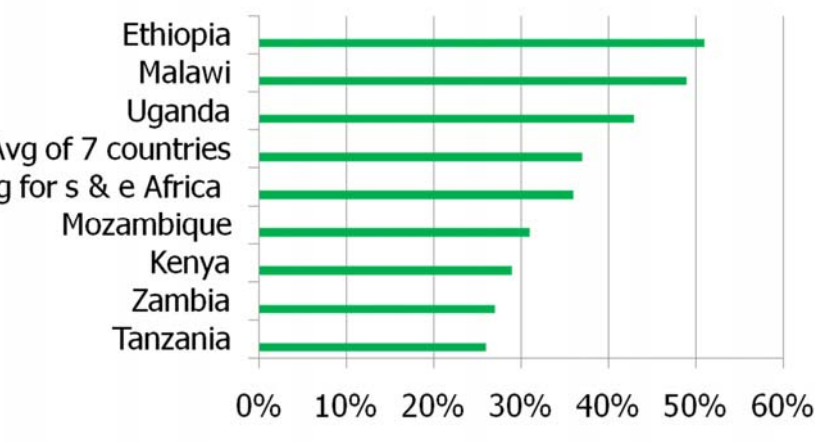
Food price instability – Definition and measurement

- Measuring food price instability
  - Coefficient of variation = CV = standard deviation/average
  - Adjusted coefficient of variation = CV with correction to remove effect of time trend
- Calculating CV in Excel
  - =stdev(*range*)/average(*range*)
  - Example: =stdev(b3:b40)/average(b3:b40)
- Simulating a random variable in Excel
  - = norminv(rand(), *mean*, *stdev*)
  - Example: to generate a random variable with mean=200 and CV = 20%, std deviation will be 40 so
    = norminv(rand(), 200, 40))

Food price instability – Definition and measurement



Magnitude of food price instability



By comparison, for six Asian countries, the CV for rice prices ranged from 12% in Bangladesh to 25% in the Philippines

Generating random variables – Exercise

- Open “Generating random variables.xls”
- Look at formula for column of numbers
  - What does C3 mean?
- Press F9 to recalculate several times
  - Why do numbers and graph change?
- Change standard deviation to 40, then 60
  - What happens to graph?
- Change standard deviation to 10, then 5
  - What happens to graph?
- Look at column G and recalculate several times
  - Why are “actual” average and std deviations different than in column C?

Understanding the Excel model of price stabilization

- Open “Model of price stabilization.xls”
- Green box contains “inputs”, that is parameters that can be changed to simulate different types of markets
  - General assumptions – To set characteristics of domestic market
  - Trade assumptions – To set characteristics of international trade and policy assumptions
  - Buffer stock assumptions – To set buffer stock policy and cost assumptions
- Yellow box contains “outputs”, that is the outcome of the assumptions made above
  - **Warning: Do not change values in the yellow box**
  - Average and CV of several variables of interest
  - Graph 1 shows prices with and without international trade
  - Graph 2 shows prices with and without buffer stock
- Calculation worksheet
  - Shows how the outputs are calculated based on the inputs

Causes of food price instability

- Variation in domestic supply of commodity
  - Particularly non-tradable commodities: maize, bananas, root crops
  - Seasonality in prices
  - Differences in size of harvest
  - Small production instability can cause large price instability
- Variation in world price of commodity
  - Usually just tradable commodities: wheat, rice, etc
  - Large effect in 2007-08 but generally little effect
  - Only 13 of 62 food prices in Africa showed significant link to world prices
- Food policy (trade policy, buffer stocks, etc)
- Price elasticity of demand
- Variation in demand (e.g. holidays)
- Changes in closely related markets
- Speculative bubbles

Causes of food price instability - Exercises

- Variation in domestic supply of commodity
  - Increase CV of production
  - Decrease CV of production
  - How does it affect CV of prices?
- Price elasticity of demand
  - Price elasticity of demand
    - Definition: percentage change in demand given a 1% increase in price
    - Price elasticity of demand is negative
    - Example: If elasticity is -2, a 1% increase in price causes a 2% decline in demand
    - Price elasticity of demand for staple food is generally in the range of -0.1 to -0.6
  - Set price elasticity of demand at -0.3, -0.5, and -1.0
  - How does it affect the food price instability?
  - Why does inelastic demand make food prices more volatile?
  - What factors determine whether demand is elastic or inelastic?

Trade and price instability

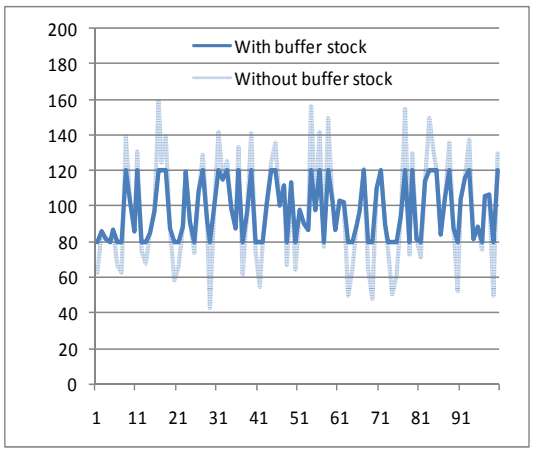
- Import parity price
  - Definition: Cost of imported product including taxes and transport to a location
  - Affected by import tariffs, cost of transportation, distance to coast, etc
  - Sets upper limit on market price of commodity if trade is allowed
- Export parity prices
  - Definition: World price of an exported good minus cost of taxes and transportation from certain location to world markets
  - Affected by export taxes, cost of transportation, distance to coast, etc.
  - Sets lower limit on market price of commodity if trade allowed
- Thus, trade sets a natural “price band” within which market prices must stay
  - But band may be very wide if distance and transport costs are high
  - Trade taxes make “price band” wider

Trade and price instability - Exercise

- Two ways to compare with and without trade
  1. Compare first and second section of yellow-shaded table
  2. Compare red line (no trade) with green line (with trade) in Figure 1
- Reduce transfer cost to/from world market from $150 to $75
  - What is maximum price with and without trade?
  - What is minimum price with and without trade?
  - What is the CV of price with and without trade?
- Add 30% import tax and 30% export tax
  - What is maximum price with and without trade?
  - What is minimum price with and without trade?
  - What is the CV of price with and without trade?
- Message: taxes on trade widen the natural "price band" that international trade provides

Food price stabilization in theory

- Idea of buffer stock
  - Buy when price is low (e.g bumper harvest)
  - Sell when price is high (e.g. drought year)
  - Effect is to raise price when low, lower price when high
- Price-band policy
  - Set ceiling price and floor price
  - Buffer stock willing and able to sell "unlimited" quantities at ceiling price
  - Buffer stock willing and able to buy "unlimited" quantities at floor price
  - Effect is to keep price between ceiling and floor price



Food price stabilization in practice

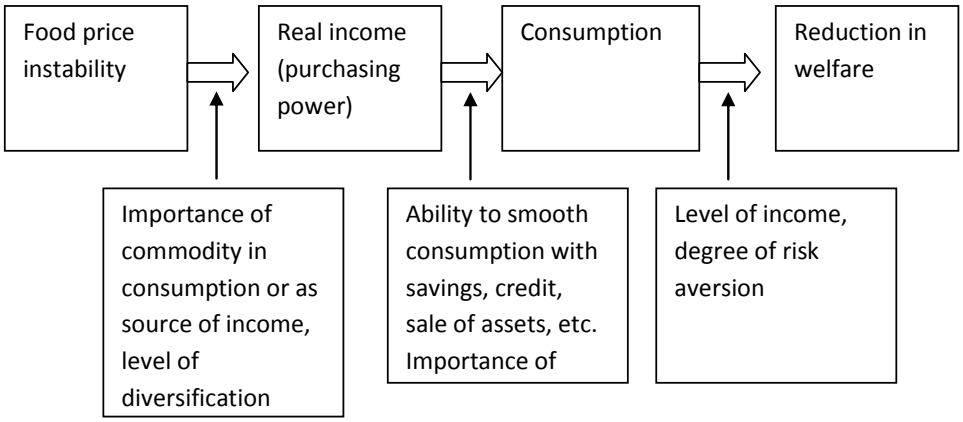
- Operation of public food reserves
  - Typically managed by state-owned enterprise
  - Reserves in main staple cereal and 1-2 others
    - Root crops and cooking bananas too
  - Food reserves in developing countries have multiple objectives
    - Price stabilization, preparation for emergencies, support farm price, keep down consumer prices, etc.
  - Food reserves use different types of interventions
    - Not just buying & selling, but import & export policy, government imports and exports, regulations of grain marketing
  - Food reserves do not use consistent buy/sell rules
    - Intervention depends on budget resources, politics, etc.

Buffer stock and price instability – Model

- Model calculates:
  - Quantity that has to be bought and sold each year to keep price inside price band
  - Quantity in storage (initial stock minus all sales plus all purchases)
  - Trading costs = cost of buying or selling stock (revenue is negative)
  - Storage cost = quantity in storage x cost per ton (initially $50/ton)
  - Transport cost = cost of moving commodity to/from warehouses
  - Interest cost = opportunity cost of capital tied up in stock
  - Total annual cost
  - Cumulative cost over the simulation (negative = revenue)
  - Balance left over = Original budget minus accumulated net costs
  - Probability of exhausting funds
  - Probability of exhausting stock
  - Probability of exceeding storage capacity
- Numbers will vary for each recalculation

1) Price instability and income instability

- Only affects households if it causes variation in income and consumption



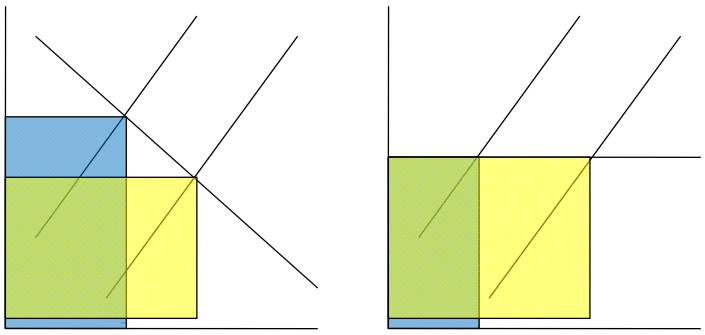
Price stability and income stability - Exercise

- Set price elasticity of demand to -1.0
  - What is CV of gross farm revenue without price stabilization?
  - Why is it so low?
  - Set buffer stock price band at 350 and 300
  - What is CV of gross farm revenue with price stabilization?
  - Why is gross farm revenue more unstable with price stabilization?
- Set price elasticity of demand to -0.5
  - Compare CV of gross farm revenue with and without stabilization
  - Why are the results different?

Price stability and income stability - Explanation

- 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



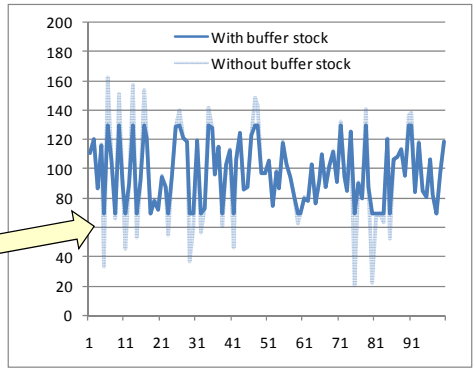
With price stabilization
Variation in output not offset by changes in price. More income instability.

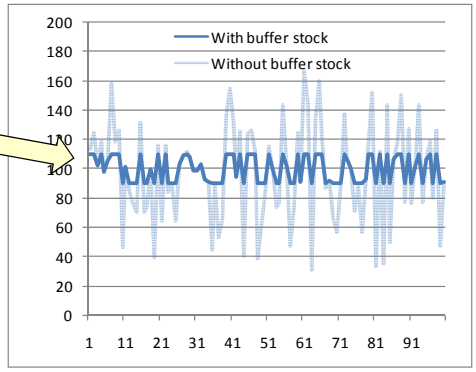
2) Effect of width of price band - Exercise

- Change from wide band to narrow band:
  Change price band from 200-600 to 300-400
  - What is the CV of price before and after?
  - What is the frequency of purchase and sale before and after?
  - How does average annual cost change?
  - What is the probability of running out of funds over 10 years?
  - What is the probability of running out of stocks over 10 years?
  - What is the probability of exceeding storage capacity over 10 years?

Width of price band

- Wide band implies:
  - Less price stabilization
  - Less frequent intervention
  - Lower cost
- Narrow band implies:
  - More price stabilization
  - More frequent intervention
  - Higher cost





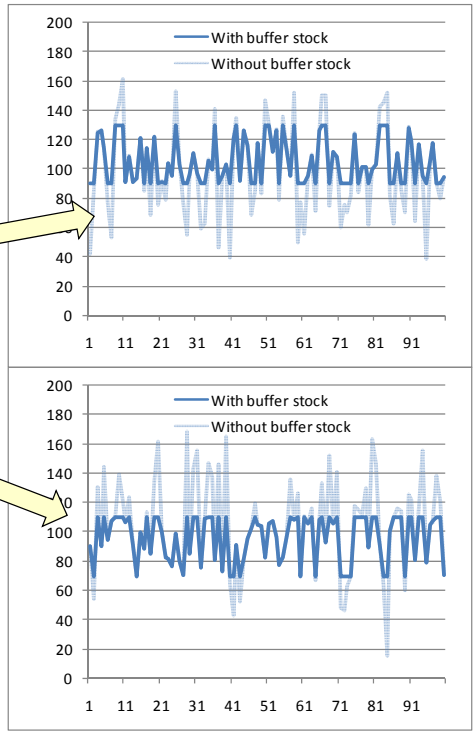
3) Effect of level of price band - Exercise

Change in level of band

- Change price band to 250-400
  - What is the CV of price?
  - What is the frequency of purchase and sale before and after?
  - What is the probability of running out of funds over 10 years?
  - What is the probability of running out of stocks over 10 years?
  - What is the probability of exceeding storage capacity over 10 years?
- Change price band to 350-500
  - What is the CV of price?
  - What is the frequency of purchase and sale before and after?
  - What is the probability of running out of funds over 10 years?
  - What is the probability of running out of stocks over 10 years?
  - What is the probability of exceeding storage capacity over 10 years?

Buffer stock

- If mid-point is too high:
  - Buying more than selling
  - Accumulation of stocks
  - Eventually exhaust funding or storage capacity
- If mid-point is too low:
  - Selling more than buying
  - Depletion of stocks
  - Eventually exhaust stocks
- One option: set mid-point at average of past 3 years



Conclusions

- Price stabilization is expensive
  - Large procurement costs (US$ 80 m in Kenya in 2006)
  - Storage, handling, and overhead
  - 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”
- Open borders provide no-cost “price band”
  - Impeding imports has exacerbated price spike in several cases
- Improve consistency and predictability in govt actions

Conclusions

- Promote private grain storage & imports
  - Credit, non-intervention, & storage rental
- Promote consumption of secondary staple crops
  - Cassava can act as shock absorber for grain markets
- Rationale for 3 months grain reserve
  - To cover period until commercial imports can be arranged
- If price stabilization politically necessary
  - Adopt rule-based price band
  - Adopt wide & market based price band