Optimal food price stabilisation in a small open developing country

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Motivation

- Large use of trade policies in the two recent food price spikes (evidence of counter-cyclical agricultural trade policies, Andersen & Nelgen, 2010):
  - Exporters have used export restrictions to isolate their markets.
  - Many importers move their tariffs to reduce their domestic price volatility.
- Very non-cooperative policies but potentially quite effective at stabilising domestic prices.
- Large use of stocks
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  - Many importers move their tariffs to reduce their domestic price volatility.
- Very non-cooperative policies but potentially quite effective at stabilising domestic prices.
- Large use of stocks (but not always in the good direction).
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Understand the motivations for and consequences of using trade and storage policies for price stabilisation purposes.
Questions

Normative approach

What is the optimal food price stabilisation policy in a small open economy when consumers are risk-averse?
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- Is increasing buffer stocks a good answer to food price instability?
- What is the optimal combination of trade and storage policy?
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→ optimal reaction of a country **neglecting the international consequences of its actions**

(≠ policy recommendations)
Our approach

Model accounting for trade and storage decisions in a stochastic context with domestic and world yield shocks.
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With rational expectations

- Expectations are endogenous,
- Private agents anticipate government’s behaviour and government accounts for this feedback in its optimal policy design.
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Set-up
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Set-up

- Market incompleteness in the storage-trade model. Consumers are assumed to be risk averse and lack insurance possibilities.
- Optimal price stabilisation policies to correct for the imperfection.
The model

Overview

- Close to Williams & Wright (1991).
- Infinite horizon partial equilibrium model with rational expectations.
- A risk-neutral storer.
- A risk-averse consumer.
- Inelastic stochastic supply.
- International trade (small country assumption).
- Normally self-sufficient country.
The model

Speculative storer

Classical storage arbitrage equation – Zero-profit condition

\[ S_t \geq 0 \quad \perp \quad \beta E_t (P_{t+1}) + \zeta_t - P_t - k \leq 0, \]

Rational expectations

with

- \( k \) unit physical storage cost.
- \( \zeta_t \) storage subsidy.
The model

International trade

Arbitrage at the export and import parity prices

\[ M_t \geq 0 \quad \perp \quad P_t - \nu_t^M - (P^w_t + \tau) \leq 0, \]
\[ X_t \geq 0 \quad \perp \quad (P^w_t - \tau) - P_t - \nu_t^X \leq 0, \]

with

- \( P^w_t \): world price generated by a rational expectations storage model.
- \( \tau \): trade costs.
- \( \nu_t^M, \nu_t^X \): import and export taxes.
Dynamics without public intervention

Price behavioural diagrams
Dynamics without public intervention

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Price behavioural diagrams

- Consumer demand function
- Price curve with trade only
- Price curve

World price: 1.1
Export parity price →

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Dynamics without public intervention

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World price: 1.2
Export parity price →
Optimal policy approach

Social welfare function

- Partial equilibrium $\Rightarrow$ Need to carefully account for each agent’s welfare,
Optimal policy approach

Social welfare function

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- Usual practice: sum of surpluses, but fails to account for risk-aversion,
Optimal policy approach

Social welfare function

- Partial equilibrium ⇒ Need to carefully account for each agent’s welfare,
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- Social welfare function ($W$), linear combination of consumer’s utility and other agents’ surplus.
Optimal policy approach

Social welfare function

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- Usual practice: sum of surpluses, but fails to account for risk-aversion,
- Social welfare function ($W$), linear combination of consumer’s utility and other agents’ surplus.

It is the concavity of the social welfare function introduced by consumer risk aversion that justifies public intervention.
Optimal policy approach

Optimisation problem

2 state-contingent instruments of policy:

- Trade policy.
- Storage subsidy.

Government lacks commitment mechanism. Its policy is discretionary obeying

$$\max_t E_t \sum_{t=0}^{\infty} \beta^i W_{t+i}$$

subject to the equations defining the recursive equilibrium.
Results

Optimal trade policy
Results

Optimal trade policy

![Diagram showing the impact of optimal trade policy on price and availability. The graph compares the price with and without intervention, illustrating a significant decrease in price variability due to optimal trade policy.]
Results

Optimal trade policy

![Graph showing the comparison of prices with and without intervention. The graph plots price against availability. The black line represents 'Without intervention,' and the pink line represents 'Trade policy.' The world price is set to 1.0.]
Results

Optimal trade policy

![Graph showing the effect of optimal trade policy on price and availability. The graph compares 'Without intervention' and 'Trade policy' scenarios. The world price is 1.1.]

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Food price stabilisation policies

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Results

Optimal trade policy

![Graph showing the effect of optimal trade policy on price and availability. The graph compares the price with and without intervention, highlighting the benefits of an optimal trade policy. The world price is set at 1.2.]
Results

Optimal trade policy

![Graph showing the impact of optimal trade policy on price and availability. The black line represents 'Without intervention', and the pink line represents 'Trade policy'. The world price is 1.3.](image)
Optimal trade policy

- Subsidise import at low availability.
- Tax export at high availability.
- $\Rightarrow$ trim high prices from the distribution.
Optimal trade policy

- Subsidise import at low availability.
- Tax export at high availability.
- \( \Rightarrow \) trim high prices from the distribution.

In reality, we do not see import subsidies so often, but decrease in import tariffs.
Results

Optimal storage policy
Results

Optimal storage policy

![Graph showing the optimal storage policy with price on the y-axis and availability on the x-axis. The graph compares the price without intervention and with storage subsidy.]
## Results

### Optimal storage policy

The graph illustrates the optimal storage policy under different availability levels. The x-axis represents availability, while the y-axis represents the price. There are two lines on the graph:

- **Black line**: Without intervention
- **Pink line**: Storage subsidy

The world price is set at 1. The graph shows how the optimal storage policy adjusts the price to stabilize it around the world price, even as availability changes.
Results

Optimal storage policy

![Graph showing the optimal storage policy with curves for Without intervention and Storage subsidy. The world price is 1.1.](image-url)
Results

Optimal storage policy

![Graph showing optimal storage policy with price and availability axes. The graph includes two lines: one for 'Without intervention' and another for 'Storage subsidy', with world price labeled as 1.2.]

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Results

Optimal policy with both instruments
Results

Optimal policy with both instruments

![Graph showing the relationship between price and availability without intervention and with both instruments]
Results

Optimal policy with both instruments

![Graph showing the optimal policy with both instruments](image-url)

Without intervention
Both instruments

World price: 1

Availability
Price
0.8 0.9 1 1.1 1.2 1.3 1.4
0.6
1
1.2
1.4
1.6

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Results

Optimal policy with both instruments

![Graph showing optimal policy with both instruments](image-url)

- **World price**: 1.1
- **Availability and Price**

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Results

Optimal policy with both instruments

![Graph showing the price of availability with and without intervention, where the world price is 1.2. The graph indicates that the policy with both instruments leads to a lower price compared to without intervention.](#)
Results

Optimal policy with both instruments

![Graph showing optimal policy with both instruments](image-url)
Results – Benchmark

Simulated price history

![Price history graph](image)

- World price
- Export and import parity prices
- Domestic price

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Results – Optimal policy

Simulated price history

![Simulated price history graph]

- **World price**
- **Export and import parity prices**
- **Domestic price**
## Results

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<th>Statistics on the asymptotic distribution</th>
<th>Benchmark</th>
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<tbody>
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<td>Mean price</td>
<td>1.039</td>
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</thead>
<tbody>
<tr>
<td>Consumers</td>
<td>2.47</td>
<td>−0.94</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>Producers</td>
<td>−2.53</td>
<td>1.08</td>
<td>−0.92</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>0.12</td>
<td>−0.12</td>
<td>−0.03</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.06</td>
<td>0.03</td>
<td>0.10</td>
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Conclusion

- Characterisation of optimal food price stabilisation policies in a small open economy.
- Stabilisation by storage alone is not desirable because of the leakage to the world market.
- Trade policy is most effective policy instrument.
- Strong complementarity of the two instruments.
- Food price stabilisation policies entail distributive effects much larger than the total welfare gains, since welfare effects are dominated by mean price changes rather than volatility change.
Perspectives

International policy coordination

- Trade policy = non-cooperative policy.
- Storage policy: inefficient in open economy for one country, but as a worldwide policy? How to share the burden of stabilisation across heterogeneous countries?
Thank you for your attention.