Trade policy coordination and food price volatility

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Extensive use of trade policies to alleviate agricultural price volatility

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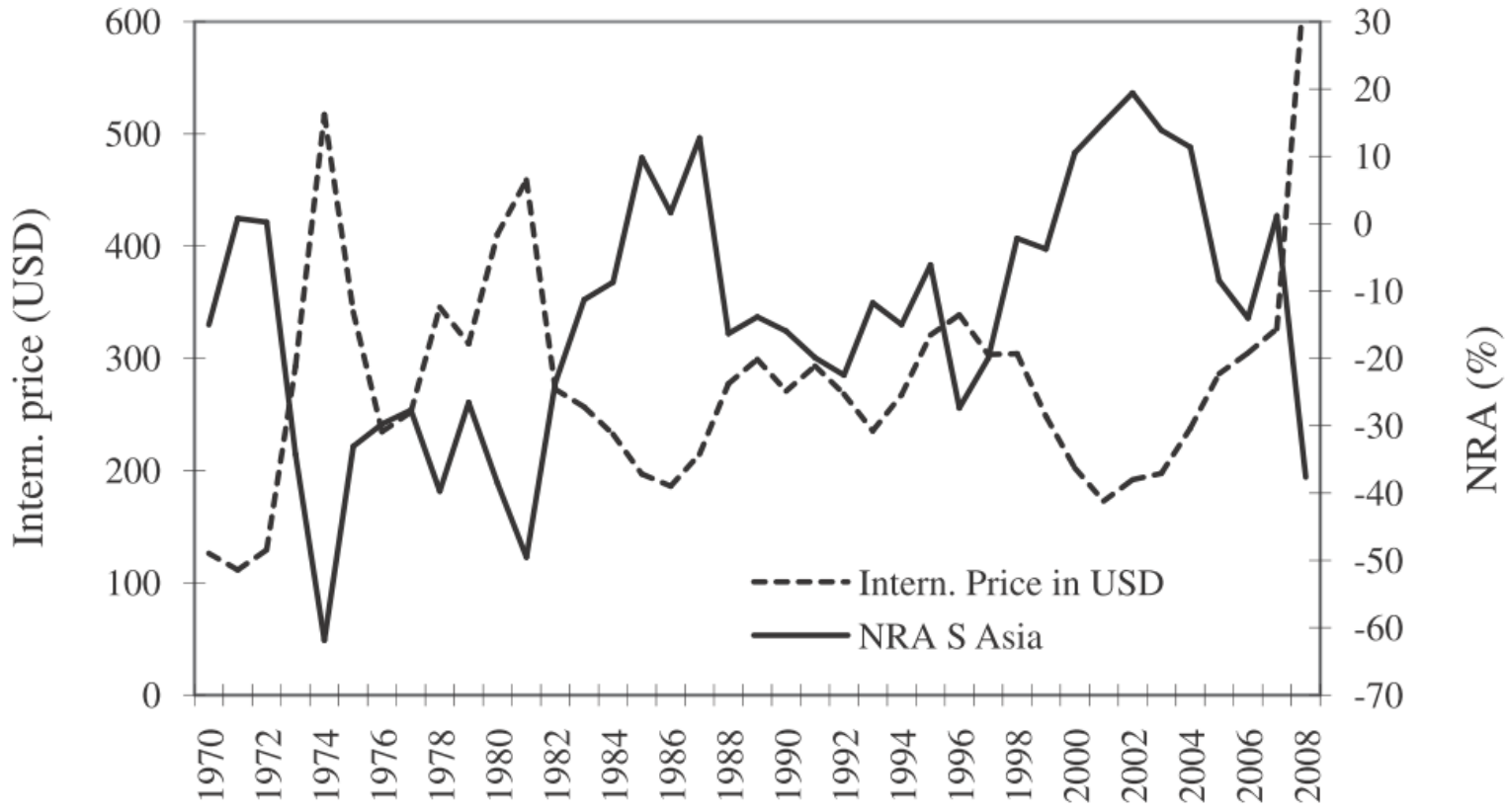
Rice nominal rate of assistance and international price (South Asia)



Source: Anderson and Nelgen (2012, World Dev.)

Countercyclical trade policies contribute to world price volatility

- The rise of rice price in 2007/08 attributed to the export bans of many key countries.
- Anderson & Nelgen (2012): back-of-the-envelope calculation to assess a contribution of trade policy to price rises in Wheat in 1972/74 and 2006/08 of 23 and 19%.
- Not limited to price spikes: in period of low world prices, countries raise tariffs or use export subsidies decreasing world price further.

Common policy advice

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Even if disciplining export restrictions would bring us closer to the first best, is it possible to achieve an international agreement on this issue?

Possibility of a self-enforcing trade agreement

- Trade agreements (or WTO) have many features of self-enforcing agreements (Bagwell & Staiger, 2010):
  - There is some punishment mechanism to enforce the agreement.
  - They must satisfy the participation constraints of each country.
  - To satisfy participation constraints in every state of the world, some deviations from first best have to be authorized (e.g., sensitive products or safeguard measures).

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- In the static Nash equilibrium, welfare is inferior to first best (i.e., free trade).
- Through repeated interactions, countries may be able to coordinate on a more cooperative policy and we study here the most cooperative equilibrium that is self-enforcing and subgame perfect.

A simple linear trade model

2 countries (Home exports) – Linear demand functions – Inelastic stochastic supply

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\begin{aligned}
D : D(P) &= a - bP, \\
X : \epsilon &= D(P) + X, \\
P^w : X + X^* &= 0, \\
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World price:

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P^w &= \frac{a - (\epsilon + \epsilon^*)/2}{b} - \frac{\tau + \tau^*}{2}, \\
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2 state variables:

- ϵ and ϵ^*,
- or equivalently free-trade world price $\left(P^{wFT}\right)$ and trade volume $\left(V^{FT} = (\epsilon - \epsilon^*)/2\right)$.

Social welfare function

Quadratic social welfare:

$$W = \underbrace{\int_{P}^{a/b} D(p)\,\mathrm{d}p}_{\text{Consumer' surplus}} + \overbrace{P\epsilon}^{\text{PS}} \underbrace{-(P - P^{w})\left[\epsilon - D(P)\right]}_{\text{Government income}} - K\frac{\left(P - \bar{P}\right)^{2}}{2}.$$

K parameterizes the country aversion to price risk.
$\bar{P}$ is a target price around which policy-makers wish prices to be stabilized (assumed to be the steady-state price).

Trade policies function of world price

Maximizing the social welfare function over tariff leads to the following expression:

$$\tau = \frac{\overbrace{K\left(\bar{P} - P^w\right)}^{\text{Smoothing}} - \overbrace{\left(\epsilon - a + bP^w\right)}^{\text{Market power}}}{K + 2b}.$$

Interior Nash equilibrium I

$$P_N^w = P^{wFT} + \frac{K}{b}\left(P^{wFT} - \bar{P}\right),$$
$$\tau_N = \frac{K}{b}\left(\bar{P} - P^{wFT}\right) - \frac{V^{FT}}{K+2b},$$
$$\tau_N^* = \frac{K}{b}\left(\bar{P} - P^{wFT}\right) + \frac{V^{FT}}{K+2b}.$$

P^{wFT} and V^{FT} correspond to 2 types of risk: aggregate and idiosyncratic risks.

Terms-of-trade (ToT) motivation for intervention changes with idiosyncratic risk, while smoothing motivation adjusts with aggregate risk.

Interior Nash equilibrium II

ToT motivation

- If $K = 0$ trade policy interventions do not affect world price because
  - Importer taxes imports decreasing world price,
  - Exporter taxes exports increasing world price.
- This trade policy intervention reduces trade level.

Interior Nash equilibrium III

Smoothing motivation

Neglecting the component related to terms of trade, the smoothing motivation in trade policies

- Increases world price volatility (variance increases by $[(K+b)/b]^2$),
- Policies offset each other and domestic prices are the same as in free trade:
  - Analogy in Martin & Anderson (2012) with a crowd standing up in a stadium to get a better view: this is self-defeating.
- Average welfare stays the same, trade policies are creating transfers:
  - In periods of scarcity, the exporter uses export restrictions and the importer subsidizes import $\Rightarrow$ Transfer from importer to exporter.
  - In periods of glut, transfer from exporter to importer.

Efficient trade policies

The trade policies that maximize joint welfare $W + W^*$ are defined by

$$\tau = \tau^*.$$

True in free trade, but also with trade policies motivated only by smoothing.

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Pb: This rests on the hypothesis that countries are perfectly able to offset the policies of their partners by using subsidies (to imports or exports).

Nash equilibrium without subsidies

Best-response functions:

$$\tau_R(\tau^*) = \min\left[2\frac{K\left(\bar{P} - P^{wFT}\right) - V^{FT}}{K+3b} + \frac{K+b}{K+3b}\tau^*, 0\right],$$

$$\tau_R^*(\tau) = \max\left[2\frac{K\left(\bar{P} - P^{wFT}\right) + V^{FT}}{K+3b} + \frac{K+b}{K+3b}\tau, 0\right].$$

For each country, Nash trade policies present 3 possible regimes:

1. $\tau = 0$, the policy is constrained in Home to be a tax.
2. Trade policies active in both countries (behavior follows previous Nash equations).
3. The policy is constrained in Foreign $\Rightarrow$ Home adjusts less its policy to world price, since its policy is not offset.

Design of a self-enforcing trade agreement

Countries' repeated interactions allow them to coordinate on more cooperative policies:

- They coordinate on protection levels lower than in the static game,
- but if one country deviates from the cooperative policy, they forever revert to the Nash.

Trade-off between

- short-run gains from deviation,
- long-run losses from returning to the Nash.

Participation constraint

This trade-off can be summarized by this participation constraint (PC):

$$\mathsf{E}_t \sum_{i=0}^{\infty} \beta^i W\left(\tau_{t+i}, \tau^*_{t+i}\right) \geq W\left(\tau_R\left(\tau^*_t\right), \tau^*_t\right) + \frac{\beta}{1-\beta} \mathsf{E}\, W_N,$$

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PC ensures that the country will respect the agreement in all states of nature.

Optimization problem

The most cooperative subgame perfect Nash equilibrium is given by

$$\max_{\tau_t \leq 0, \tau_t^* \geq 0} W\left(\tau_t, \tau_t^*\right) + W^*\left(\tau_t, \tau_t^*\right) + \mathrm{E}_t \sum_{i=1}^{\infty} \beta^i \left[W\left(\tau_{t+i}, \tau_{t+i}^*\right) + W^*\left(\tau_{t+i}, \tau_{t+i}^*\right)\right]$$

subject to PCs of both countries (to which are associated the positive Lagrange multipliers μ_t and μ_t^*)

First-order conditions

$$\tau_t : \tau_t \leq 0 \perp (1+\mu_t)\frac{\mathrm{d}W(t)}{\mathrm{d}\tau_t} + (1+\mu_t^*)\frac{\mathrm{d}W^*(t)}{\mathrm{d}\tau_t} \geq \mu_t^* \frac{\mathrm{d}W^*(\tau_t, \tau_R^*(\tau_t))}{\mathrm{d}\tau_t},$$

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Efficient policies would be determined by

$$\frac{\mathrm{d}W(t)}{\mathrm{d}\tau_t} + \frac{\mathrm{d}W^*(t)}{\mathrm{d}\tau_t} = 0,$$

so Lagrange multipliers play the role of the relative weighting of countries in world welfare. When one PC is binding, the corresponding welfare weight becomes positive, justifying a deviation from free trade.

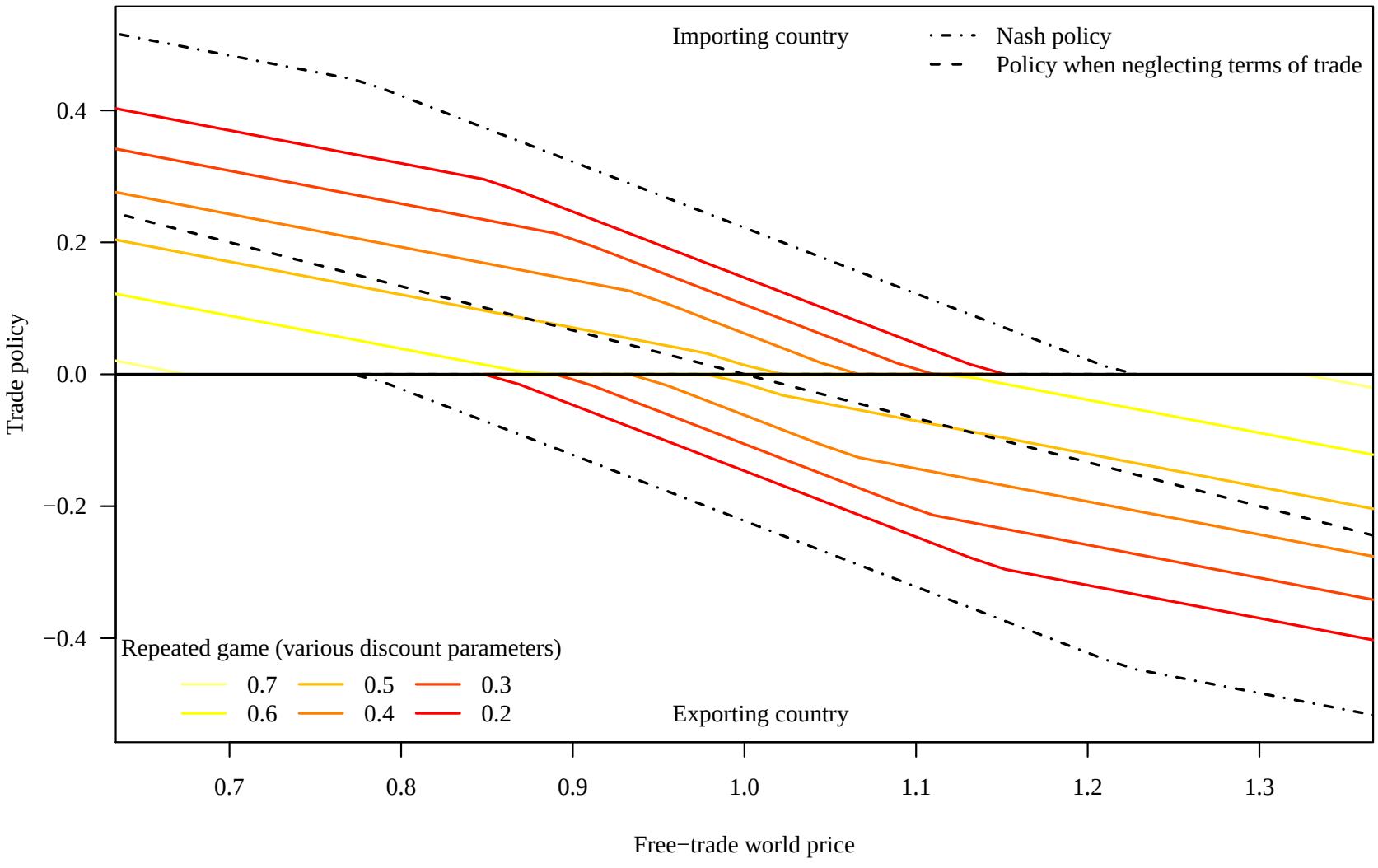
Numerical illustration

Because of the numerous binding constraints, it is not possible to characterize analytically the solution.

Numerical illustration with the case of a pure aggregate risk:

- Steady-state price: 1.
- Coefficient of variation of world price: 21%.
- Steady-state demand: 1.
- Steady-state trade level: 0.2.

Symmetric price distribution



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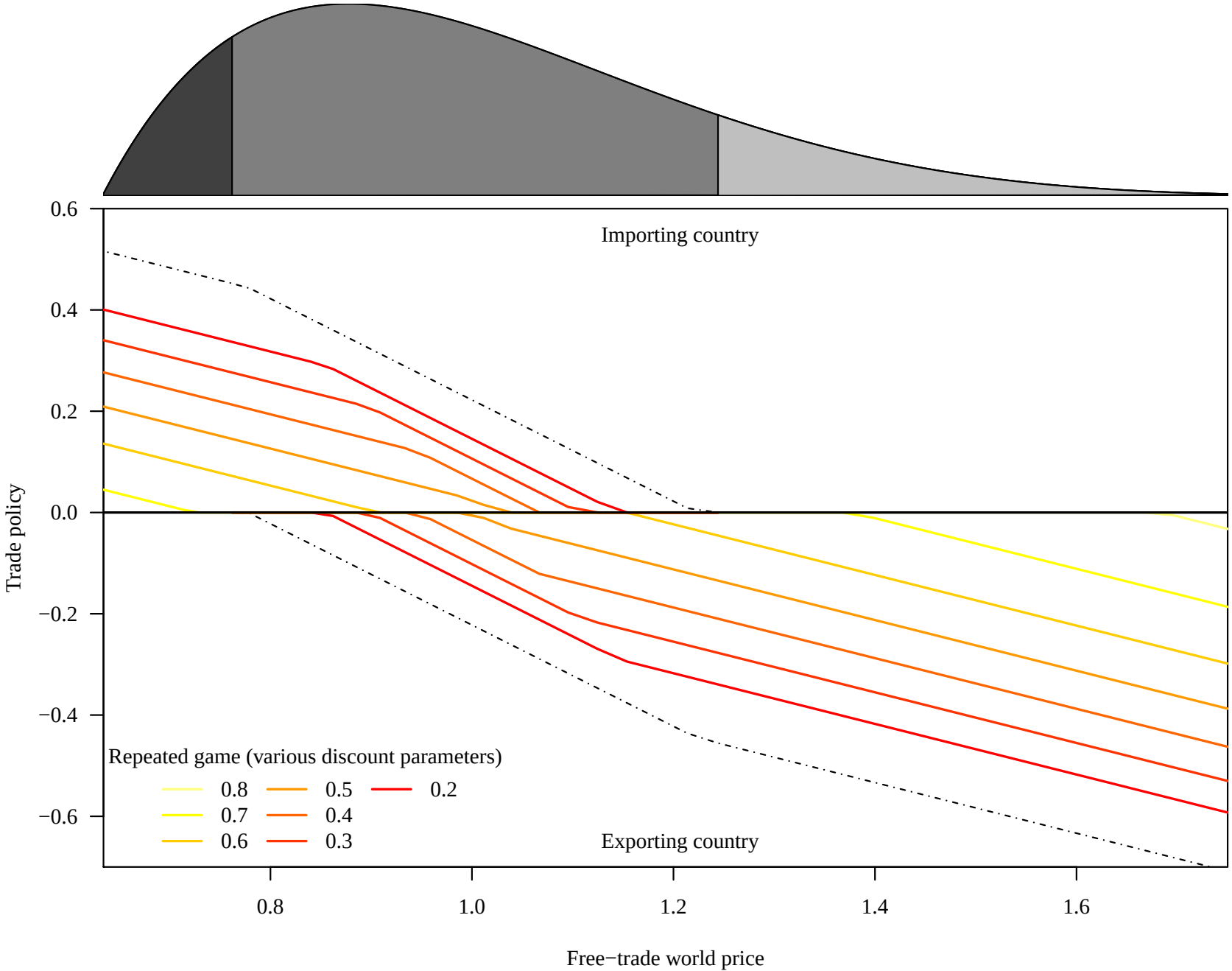
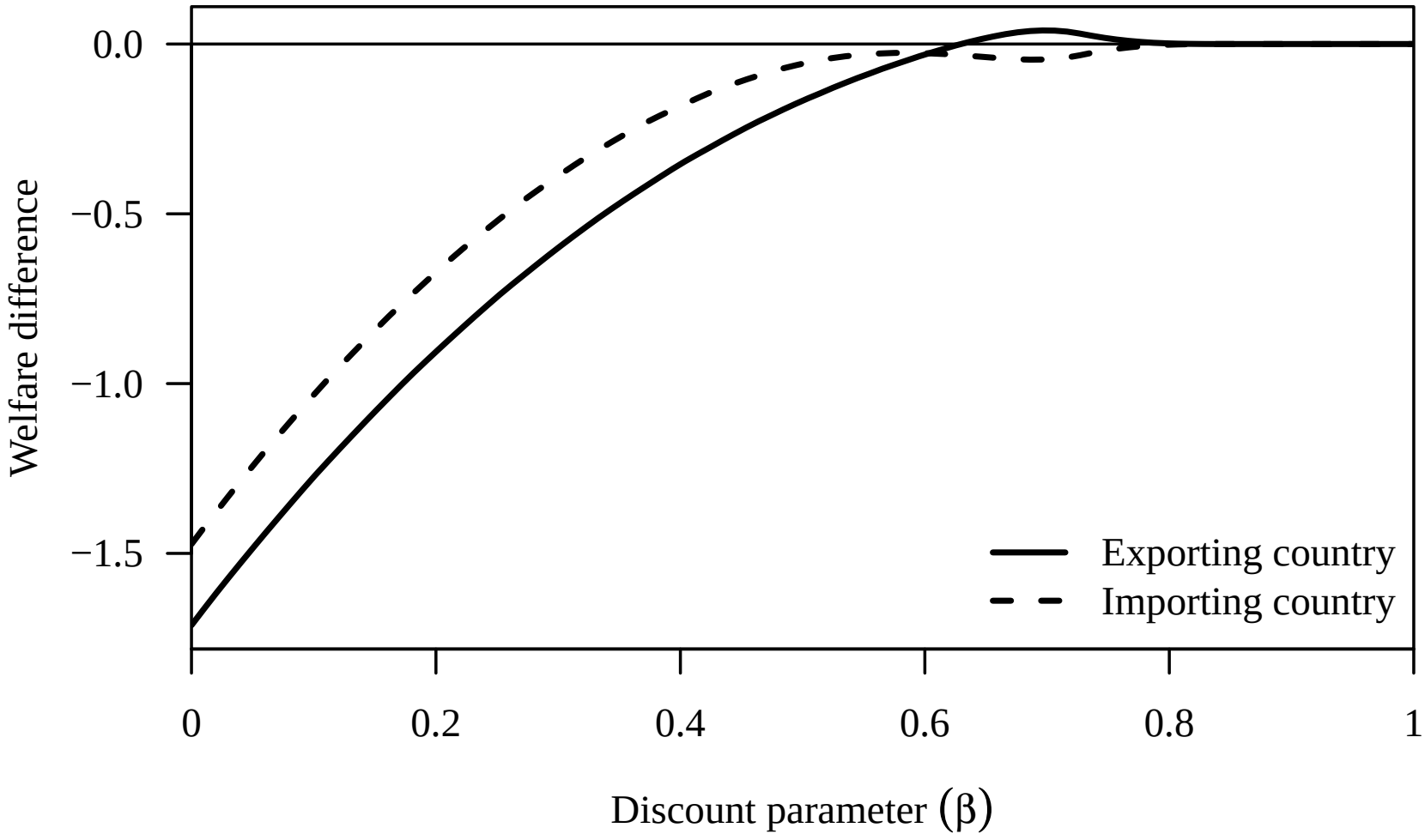


Welfare under asymmetric price distribution



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- Export restrictions do not play in this work a more important role than tariffs. The former are the policy used by exporters and the latter the policy used by importer, but both contribute to shift volatility to partners' markets.

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- Export restrictions do not play in this work a more important role than tariffs. The former are the policy used by exporters and the latter the policy used by importer, but both contribute to shift volatility to partners' markets.
- Export restrictions may be more difficult to avoid in cooperation than tariffs because of the asymmetry of the price distribution.

Open issues

Gradualism How do past agreements influence the likelihood and the structure of future agreements?

Weak bindings WTO and trade agreements imply weak bindings (maximum levels of trade intervention that should not be exceeded), not strong bindings. How would the results translate with weak bindings?

Thank you for your attention.