Food Policy in a Warming World

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CBOT wheat ($ per bushel)

Source: Refinitiv

This paper

- The typical view is that trade facilitates climate adaptation
  - But for India, trade policy responded to climate shocks
- **How does trade policy affect global capacity to adapt?**
  - Aggregate vs. distributional effects
  - Exogenous vs. endogenous trade policy

Data by crop, country, and year

- Agricultural trade policy
  - World Bank: NRA price distortions for 80 crops and 81 countries, 1955 to 2011
- Extreme heat exposure (Moscona & Sastry 2023)
  - ERA-5: temperatures
  - FAO: crop-specific temperature sensitivity
  - Earthstat: global geography of agricultural production
- Production and trade
  - FAO: production, exports, and imports

How have temperature shocks affected trade policy historically?

	(1)	(2)	(3)	(4)
Dependent Variable:	Nominal Rate of Assistance		Nominal Rate of Assistance (Output)	Nominal Rate of Assistance (Input)
Extreme Temperature, future decade		-0.0243		
		(0.0655)		
Extreme Temperature	-0.106**		-0.109**	0.000861
	(0.0504)		(0.0515)	(0.00246)
Country x Year Fixed Effects	Yes	Yes	Yes	Yes
Country x Crop Fixed Effects	Yes	Yes	Yes	Yes
Crop x Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,895	1,568	1,895	1,895
R-squared	0.904	0.935	0.904	0.899

A small, importing economy

- Sets import tariffs $\tau(\omega, \lambda)$
  - World price p^w
  - Domestic production shocks ω
  - Welfare weights $\lambda = \{\lambda^d, \lambda^s, \lambda^g\}$
- Free trade allows full adaptation
  - As imports replace lost domestic production
  - Compare neutrality vs. consumer control vs. producer control

Equilibrium

$$q^d(p^*) = (1-\omega)q^s(p^*) + q^m(p^*)$$
$$p^* = (1+\tau)p^w$$

$$\frac{\partial p^*}{\partial \tau} > 0, \quad \frac{\partial q^{d*}}{\partial \tau} < 0, \quad \frac{\partial q^{s*}}{\partial \tau} > 0, \quad \frac{\partial q^{m*}}{\partial \tau} < 0$$

$$W(\tau;\omega,\lambda) = \lambda^d\left(\int_{p^*}^{\infty} q^d(p)dp\right) + \lambda^s\left(\int_0^{p^*}(1-\omega)q^s(p)dp\right) + \lambda^g(\tau p^w q^{m*})$$

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$$

A neutral government ($\lambda^d = \lambda^s = \lambda^g$)

$$W^n(\tau;\omega) = \int_{p^*}^{\infty} q^d(p)dp + \int_0^{p^*} (1-\omega)q^s(p)dp + \tau p^w q^{m*}$$

$$\tau^{n*} = 0$$

- Imports allow full resilience to ω
- Neutrality implies zero tariffs

A consumer-controlled government ($\lambda^d = \lambda^g$, $\lambda^s = 0$)

$$W^d(\tau;\omega) = \int_{p^*}^{\infty} q^d(p)dp + \tau p^w q^{m*}$$

$$\tau^{d*} = -\left[-\varepsilon^d \left(1 - \frac{q^{m*}}{q^{d*}} \right)^{-1} + \varepsilon^s + 1 \right]^{-1} < 0, \quad \frac{\partial|\tau^{d*}|}{\partial\omega} < 0$$

- Import subsidies help consumers, but this help is costly
- Imports increase with ω, so per-unit subsidies fall to reduce total costs
- Lower subsidies act like a tax, impeding adaptation

A producer-controlled government ($\lambda^s = \lambda^g$, $\lambda^d = 0$)

$$W^s(\tau;\omega) = \int_0^{p^*} (1-\omega) q^s(p) dp + \tau p^w q^{m*}$$

$$\tau^{s*} = \left[\varepsilon^s \left(1 - \frac{q^{m*}}{q^{d*}}\right) - \varepsilon^d - 1\right]^{-1} > 0, \quad \frac{\partial \tau^{s*}}{\partial \omega} > 0 \text{ for } -\varepsilon^d > 1$$

- Import tariffs protect producers from foreign competition
- Protection increases with ω, impeding adaptation

Summary

- Endogenous trade policy impedes global adaptation
  - With important distributional consequences
- Goal: quantitative model of welfare loss from climate change