A Theory of Gradual Trade Liberalization and Retrenchment

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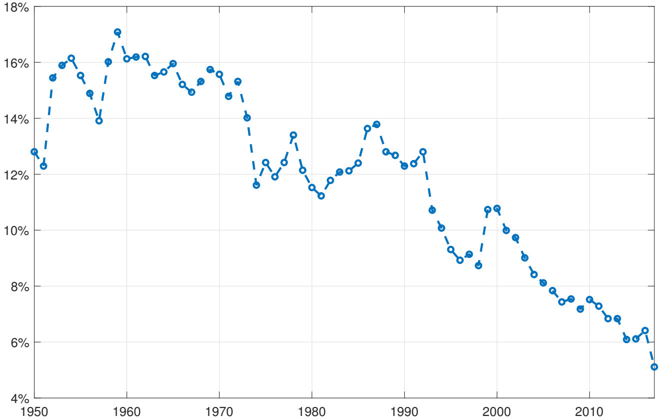
Trade Cooperation Did not Happen Overnight

- GATT (1947)
- Tokyo round (1973-1979)
- Uruguay round (1986-1994)
- WTO (1995)
- Doha round (2001-...)

World Average Tariff



Source: Antras (2020)

Trade Cooperation also Did not Break Down Overnight

- Tariffs are increasing lately, but not going up overnight
- No complete breakdown of negotiations

Trade Policy as a Time-Consistency Problem

- Short run: free trade hurts favored constituencies
- Long run: free trade promotes investment and growth, benefits everybody

Time-Consistency and Equilibrium

- Two Benchmarks:
  - Markov equilibrium
  - Sequential equilibrium/sustainable plan

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- Markov equilibrium:
  - Interesting comparative statics
  - Outcome determined by fundamentals
  - ... but can be largely improved upon

Time-Consistency and Equilibrium

- Two Benchmarks:
  - Markov equilibrium
  - Sequential equilibrium/sustainable plan
- Markov equilibrium:
  - Interesting comparative statics
  - Outcome determined by fundamentals
  - ... but can be largely improved upon
- Sequential equilibrium:
  - Can often attain very good outcomes (folk theorem)
  - Can also attain very bad outcomes (folk theorem again)
  - Relies on self-punishment as a threat
  - Weak predictions (big set of equilibria)

Equilibrium Properties

- Compare with Markov equilibrium
  - payoff only depends on state variables, like Markov equilibrium
  - action can depend on history, different from Markov equilibrium
- Compare with sequential equilibrium
  - no self-punishment
  - Refinement I: same continuation value on or off equilibrium path
  - Refinement II: no one wants to deviate and wait for a restart of the game

Setup

- Two countries, home and foreign
- Two tradeable intermediate goods, 1 and 2
- One final good
- Two types of hands-to-mouth households per country (continuum of unit mass)
- Each type has one unit of labor usable in one of the sectors
  - labor immobile across sectors and countries
- A group of capitalists making saving decisions

Technology

- Home country in sector i

$$A_i K_t^{1-\alpha} l_{it}^{1-\alpha} k_{it}^{\alpha}$$

- $A_1 > A_2$
- Foreign: symmetric (A_1 TFP of intermediate 2)
- Final good (can be consumed or invested as capital):

$$y_t = [0.5^{1-\rho} m_{1t}^{\rho} + 0.5^{1-\rho} m_{2t}^{\rho}]^{\frac{\rho-1}{\rho}}$$

Government Policy

- A tariff τ_t on imports, revenues rebated to workers
- Study cooperative solution across the two countries

Preferences

- Workers:

$$\sum_{t=0}^{\infty} \beta^t \log c_{it}$$

- Capitalists:

$$\sum_{t=0}^{\infty} \beta^t \frac{c_{it}^{1-\sigma}}{1-\sigma},$$

  $\sigma < 1$

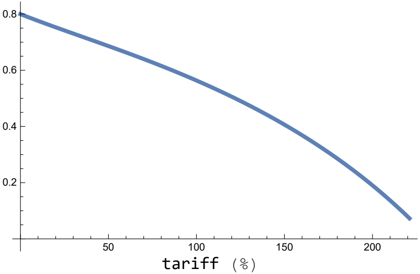
- Government:

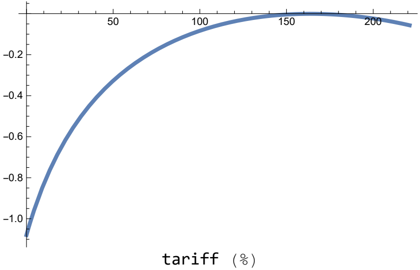
$$U_t \equiv ((1-\lambda) \log c_{1t} + \lambda \log c_{2t}) + \beta E_t U_{t+1}$$

Time Inconsistency

- A tariff protects the wages of sector-2 workers in the home country (and sector-1 workers in the foreign country)
- A tariff discourages saving, hurts everybody in the long run

Static Welfare for Type 1 and Type 2 Agents





Static CE equations

Dynamic Competitive Equilibrium

- Static conditions +
- Capitalists' Euler equation:

$$\left(\frac{1-s_t}{s_t}\right)^{-\sigma} = \beta\left(r(\tau_{t+1})+1-\delta\right)^{1-\sigma}\left(1-s_{t+1}\right)^{-\sigma}$$

- Saving increasing in r_{t+1}, decreasing in τ_{t+1}

Government Welfare in Dynamic Competitive Equilibrium

$$
\begin{aligned}
U_t =& \frac{1}{1-\beta} \log K_t + \sum_{v=0}^{\infty} \beta^v \chi(\tau_{t+v}) \\
&+ \frac{\beta}{1-\beta} \sum_{v=0}^{\infty} \beta^v \left(\log s_{t+v} + \log \left(r(\tau_{t+v}) + 1 - \delta \right) \right).
\end{aligned}
$$

- Initial capital factors out
- Time consistency:
  - s_t depends on τ_{t+1} (and $\tau_{t+2}, \ldots$)
  - As of time $t+1$, s_t is sunk (into K_{t+1})

Benchmark I: Markov Perfect Equilibrium

$$U_t = \frac{1}{1-\beta}\log K_t + \sum_{v=0}^{\infty}\beta^v \chi(\tau_{t+v}) + \frac{\beta}{1-\beta}\sum_{v=0}^{\infty}\beta^v\left(\log s_{t+v} + \log\left(r(\tau_{t+v}) + 1 - \delta\right)\right).$$

$$\left(\frac{1-s_t}{s_t}\right)^{-\sigma} = \beta\left(r(\tau_{t+1}) + 1 - \delta\right)^{1-\sigma}\left(1 - s_{t+1}\right)^{-\sigma}$$

- Take future $\tau(k)$ as given (here, just constant τ)
- Maximize wrt τ_t
- Solve for fixed point τ^M
- Here, trivial (s_t does not depend on τ_t), maximize

$$\chi(\tau_t) + \frac{\beta}{1-\beta}\log r(\tau_t)$$

Benchmark II: Ramsey Allocation with Commitment

$$
\begin{aligned}
U_t = & \frac{1}{1-\beta} \log K_t + \sum_{v=0}^{\infty} \beta^v \chi(\tau_{t+v}) \\
& + \frac{\beta}{1-\beta} \sum_{v=0}^{\infty} \beta^v \left(\log s_{t+v} + \log \left(r(\tau_{t+v}) + 1 - \delta \right) \right).
\end{aligned}
$$

$$
\left(\frac{1-s_t}{s_t} \right)^{-\sigma} = \beta \left(r(\tau_{t+1}) + 1 - \delta \right)^{1-\sigma} \left(1 - s_{t+1} \right)^{-\sigma}
$$

- Choose all future allocations at period 0
- $\tau_0 = \tau^M$
- $\tau_t < \tau^M$ since it affects difference equation

Key Condition: Separability

$$U_t = \frac{1}{1-\beta}\log K_t + \sum_{v=0}^{\infty}\beta^v \chi(\tau_{t+v})$$
$$+ \frac{\beta}{1-\beta}\sum_{v=0}^{\infty}\beta^v\left(\log s_{t+v} + \log\left(r(\tau_{t+v}) + 1 - \delta\right)\right).$$

$$\left(\frac{1-s_t}{s_t}\right)^{-\sigma} = \beta\left(r(\tau_{t+1}) + 1 - \delta\right)^{1-\sigma}\left(1 - s_{t+1}\right)^{-\sigma}$$

Express as

$$\log K_t + V(\tau_t, \tau_{t+1}, \tau_{t+2}, ...)$$

Organizational equilibrium deals with V

Organizational Equilibrium

Proposition

A sequence $\{\bar{\tau}_t\}_{t=0}^{\infty}$ that satisfies the following properties is an organizational equilibrium:

1. *No-restarting:*

$$V(\bar{\tau}_t, \bar{\tau}_{t+1}, \bar{\tau}_{t+2}, ...) = \bar{V} \quad \forall t \geq 0;$$

2. *Optimality: No other sequence satisfying no-restarting achieves a higher constant value;*
3. *No-delay:*

$$V(\bar{\tau}_0, \bar{\tau}_1, \bar{\tau}_2, ...) \geq \max_{\tau} V(\tau, \bar{\tau}_0, \bar{\tau}_1, ...).$$

- It is a proposition, not a definition, because OE is defined in terms of a game

Where Do these Properties Come From?

- No-restarting:
  - akin to symmetry in Kocherlakota
  - From renegotiation proofness
  - If equilibrium is too generous to player 0, player 1 wants to forget the past.

- Optimality: no waste

- No-delay: who should start this game?
  - Comes from any ambiguity to the answer.
  - Many revolutions talk about "forgetting the past"
  - "This time's different"
  - Time 0 could be any time, and player 0 should not have an incentive to wait it out

Computational Roadmap

- Compute best steady state for

$$V(\bar{\tau}, \bar{\tau}, \bar{\tau}, ...) = \bar{V}$$

- Get difference equation from

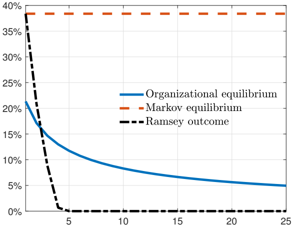
$$V(\bar{\tau}_t, \bar{\tau}_{t+1}, \bar{\tau}_{t+2}, ...) = \bar{V}$$

(easier to get difference equation for s_t and deduce τ_t)

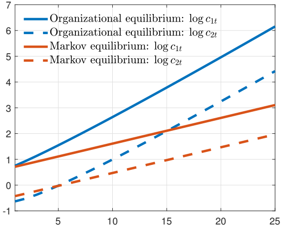
- Initial condition:

$$V(\bar{\tau}_0, \bar{\tau}_1, \bar{\tau}_2, ...) > V(\tau^M, \bar{\tau}_0, \bar{\tau}_1, ...)$$

Comparing Different Equilibria



Tariff in Various Equilibria



Consumption of Workers in Various Equilibria

Introducing uncertainty (in progress)

- Shock to government preferences:

$$U_t \equiv ((1-\lambda_t)\log c_{1t} + \lambda_t \log c_{2t}) + \beta E_t U_{t+1}$$

- High $\lambda_t \implies$ higher tariff today, but lower saving

Key Equations 1: Constant Value

- Constant expected value before shock is realized:

$$\begin{aligned}\bar{V} =& E_{t-1}\sum_{s=0}^{\infty}\beta^s\chi(\tau_{t+s},\lambda_{t+s}) \\ &+\frac{\beta}{1-\beta}E_{t-1}\sum_{s=0}^{\infty}\beta^s(\log s_{t+s}+\log(r(\tau_{t+s})+1-\delta)).\end{aligned}$$

- Above yields

$$\bar{V}(1-\beta) = E_{t-1}\chi(\tau_t,\lambda_t)+\frac{\beta}{1-\beta}E_{t-1}(\log s_t+\log(r(\tau_t)+1-\delta)).$$

Key Equations 2: Euler Equation of the Capitalists

$$\left(\frac{1-s_t}{s_t}\right)^{-\sigma} = \beta E_t \left(r(\tau_{t+1}) + 1 - \delta\right)^{1-\sigma} \left(1 - s_{t+1}\right)^{-\sigma}.$$

Note: it holds state by state in period t (so, with two possible states, H and L, two equations

Key Equations 3: Incentive-Compatibility Constraint

- With 2 shocks:

$$
\begin{aligned}
&\chi(\tau_t^L, \lambda_t^H) + \frac{\beta}{1-\beta}(\log s_t^L + \log(r(\tau_t^L) + 1 - \delta)) \\
\leq &\chi(\tau_t^L, \lambda_t^H) + \frac{\beta}{1-\beta}(\log s_t^H + \log(r(\tau_t^H) + 1 - \delta)).
\end{aligned}
$$

- Overall computational strategy:
  - Given initial conditions s_t^L, s_t^H,
  - solve 4 equations for $s_{t+1}^L, s_{t+1}^H, \tau_t^L, \tau_t^H$

Static Competitive Equilibrium, part 1 (period t, K_t given)

- Fraction of capital allocated to sector 2:

$$\phi_t := \left(1 + \left(\frac{A}{1+\tau_t}\right)^{\frac{1}{1-\alpha}}\right)^{-1}, \qquad \frac{\partial \phi}{\partial \tau_t} > 0$$

- Relative price of intermediates (equilibria with trade): $p_{1t}/p_{2t} \equiv p_{1t} = 1/(1+\tau_t)$
- Price index:

$$\mathcal{P}_t = \left[0.5 p_{1t}^{\frac{\rho}{\rho-1}} + 0.5\right]^{\frac{\rho-1}{\rho}}$$

Static Competitive Equilibrium, part 2

- Real wage in the export-let sector:

$$w_{1t} = (1-\alpha)(1+\tau_t)^{-1} A (1-\phi_t)^{\alpha} K_t / \mathcal{P}_t, \qquad \frac{\partial w_{1t}}{\partial \tau_t} < 0$$

- Wage in the import-competing sector:

$$w_{2t} = (1-\alpha)\phi_t^{\alpha} K_t / \mathcal{P}_t, \qquad \frac{\partial w_{2t}}{\partial \tau_t} > 0$$

- Rental rate of capital:

$$r_t = \alpha \phi_t^{\alpha-1} / \mathcal{P}_t, \qquad \frac{\partial r_t}{\partial \tau_t} < 0$$

Within-Period Welfare

- Workers:

$$\log c_{it} = \chi_i(\tau_t) \log K_t$$

- Government:

$$\chi(\tau_t) := [\lambda \chi_1(\tau_t) + (1-\lambda)\chi_2(\tau_t)] \log K_t$$

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