On the Role of Trade Agreements in Imperfectly Competitive Markets

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Introduction

- **Purpose of Trade Agreements:**
  - Mutual gains for member governments
  - Perfectly competitive markets
  - Terms of trade externality

- **Trade Policy and Imperfect Competition**
  - Terms of trade externality
  - Oligopoly profit shifting
  - Firm delocation

- **Trade Agreements and Imperfect Competition**
  - Step 1: Why are noncooperative policies inefficient?
  - Step 2: How should a trade agreement be designed?
  - We focus here on Step 1

- Main finding: When markets are imperfectly competitive and governments have sufficient trade policy instruments, noncooperative policies are inefficient iff governments are motivated by the terms of trade consequences of their trade policy decisions.
Overview: Fixed Number of Firms

- **Domestic Export Monopoly**
  - Demand in both countries
  - Analyze integrated (and segmented) markets
  - Export tariff lessens domestic distortion, import tariff extracts profit
  - Politically optimal policies are efficient

- **Single Domestic Exporter, Single Foreign Import-Competing Firm**
  - Demand in both countries, Cournot competition
  - Analyze integrated (and segmented) markets
  - Identify profit shifting as a local-price externality
  - Politically optimal policies are efficient

- **Third-Market Models**
  - Brander-Spencer (1985) model of export subsidies
  - Include import policy for third country
  - Identify profit-shifting as a local-price externality
  - Politically optimal policies are efficient
Overview: Free-Entry

- **Segmented Markets**
  - Demand in both markets, Cournot competition
  - Firm delocation effects
  - Import tariffs to lower domestic prices
  - Politically optimal policies are efficient
  - Brander, Brander-Krugman, Helpman-Krugman, Venables (85)

- **Integrated Markets**
  - Monopolistic competition with transportation costs
  - Firm delocation effects
  - Terms of trade effects on export policies only
  - Politically optimal tariffs are efficient
  - Helpman-Krugman, Krugman, Ossa, Venables (87)
Perfect competition, GE, 2 countries, 2 goods
Gov’t preferences, \( W(P, P^w) \) and \( W^*(P^*, P^w) \)
Nash FOC for Home:
\[
\frac{\partial W}{\partial P} dP + \frac{\partial W}{\partial P^w} \frac{dP^w}{d\tau} = 0
\]
Political Optimum:
\[
\frac{\partial W}{\partial P} = 0 = \frac{\partial W^*}{\partial P^*}
\]
As if govt’s don’t value gains from TOT changes:
\[
\frac{\partial W}{\partial P^w} \equiv 0 \equiv \frac{\partial W^*}{\partial P^w}
\]
Could also think of as small country
\[
\frac{\partial P^w}{\partial \tau} = 0 \equiv \frac{\partial P^w}{\partial \tau^*}
\]
Step 1 result: Politically optimal tariffs are efficient
Step 2: Reciprocity fixes \( P^w \) and is efficiency enhancing
DOMESTIC EXPORT MONOPOLY: INTEGRATED MARKETS

- PE model
- Domestic Monopoly Exporter
- Domestic local price and demand: \( P \) and \( D(P) \)
- Foreign local price and demand: \( P^* \) and \( D^*(P^*) \)
- Domestic export tariff: \( t \)
- Foreign import tariff: \( t^* \)
- Integrated markets:
  \[ P^* = P + t + t^* \]
- World (offshore) price:
  \[ P^w \equiv P + t = P^* - t^* \]
Monopoly Pricing

- Choose $P$ (and thus $P^*$) to maximize
  \[ \Pi(P, t + t^*) = [P - c]D(P) + [P - c]D^*(P + t + t^*) \]

- Monopoly local prices:
  \[ P(t + t^*) \text{ and thus } P^*(t + t^*) = P(t + t^*) + t + t^* \]

- Implied world price: $P_w(t, t^*) = P + t = P^* - t$

- Assume:
  \[ P'(t + t^*) < 0 < P^{*'}(t + t^*) \]
  and thus
  \[ \frac{\partial P^w}{\partial t^*} < 0 < \frac{\partial P^w}{\partial t} \]

- A higher (own) tariff improves a country’s terms of trade
Domestic and Foreign Welfare

- **Domestic Welfare:**

\[
[P - c]D(P) + CS(P) + [P^* - (c + t + t^*)]D^*(P^*) + tD^*(P^*)
\]

or

\[
W(P, P^*, P^w) = [P - c]D(P) + CS(P) + [P^w - c]D^*(P^*)
\]

- **Foreign Welfare**

\[
W^*(P^*, P^w) = CS^*(P^*) + [P^* - P^w]D^*(P^*)
\]

- Domestic welfare now depends on \( P^* \); by contrast, competitive models have price-taking export sector, \( E(P) \), and thus \( W(P, P^w) \).

- Two international externality channels: \( P^* \) and \( P^w \)

- Joint welfare is independent of \( P^w \)
Nash Trade Policies

- FOCs that determine $t^N$ and $t^*N$

\[
\frac{dW}{dt} = W_P \frac{dP}{dt} + W_{P^*} \frac{dP^*}{dt} + W_{Pw} \frac{\partial P^w}{\partial t} = 0
\]

\[
\frac{dW^*}{dt^*} = W_{P^*} \frac{dP^*}{dt^*} + W_{P^*} \frac{\partial P^w}{\partial t^*} = 0
\]

- Home: Export tariff lessens domestic distortion, but export subsidy *might* be optimal by facilitating greater price spread that would enable the monopolist to price discriminate in favor of foreign market

- Foreign: Import tariff is optimal, for TOT reasons.

- Recall joint welfare independent of TOT

- Are there other sources of inefficiency, too?
Efficient Trade Policies

- Takes intuitive form:

\[
J(P, P^*) = [P - c]D(P) + CS(P) + [P^* - c]D^*(P^*) + CS^*(P^*)
\]

- 1st best: \( P = c = P^* \) can’t be achieved w/ import & export tariffs.
- 2nd best: \( c < P, c < P^* \)
- Efficient FOC’s

\[
\begin{align*}
\frac{dJ}{dt} &= W_P \frac{dP}{dt} + W_{P^*} \frac{dP^*}{dt} + W_{P^*} \frac{dP^*}{dt} = 0 \\
\frac{dJ}{dt^*} &= W_P \frac{dP}{dt^*} + W_{P^*} \frac{dP^*}{dt^*} + W_{P^*} \frac{dP^*}{dt^*} = 0
\end{align*}
\]

- Recall: \( P \) and \( P^* \) depend on total tariff: \( t + t^* \). One indep. equation.
- At Nash tariffs, \( \frac{dJ}{dt} < 0 \). Total tariff is too high.
Politically Optimal Tariffs

- **Politically Optimal Tariffs**: those tariffs that would hypothetically be chosen by govt’s unilaterally if they did not value the pure international rent-shifting associated with the TOT movements induced by their unilateral tariff choices.
- Home behaves as if $W_{PW} \equiv 0$ and foreign behaves as if $W_{P*W} \equiv 0$
- The PO tariffs thus satisfy
  \[ W_P \frac{dP}{dt} + W_{P*} \frac{dP^*}{dt} = 0 = W_{P*} \frac{dP^*}{dt} \]

Recall that the efficient total tariff satisfies
  \[ \frac{dJ}{dt} = W_P \frac{dP}{dt} + W_{P*} \frac{dP^*}{dt} + W_{P*} \frac{dP^*}{dt} = 0 \]

**Result**: The politically optimal tariffs are efficient.

Political Optimum: Import tariff is zero. Export tariff/subsidy minimizes domestic and foreign markup distortions and depends on relative demand slopes
Interpreting PO tariffs

- As if govt's ignore any transfer in tariff revenue attributable to a change in the world price at a fixed volume of trade.
- Alternative small country interpretation: no longer valid, since the exporting firm is large.
- A small country would set $W_P = 0$. A country with a large firm must recognize that its tariff affects the price charged to final consumers and thus the volume of trade.
- Home thus now ignores TOT effects by setting $W_P \frac{dP}{dt} + W_{P*} \frac{dP^*}{dt} = 0$.
Figure 1
Effect of export tariff increase in foreign market
\[ W = [P - c]D(P) + CS(P) + [P^w - c]D^*(P^*) \]
Figure 2
Figure 2
Effect of export tariff increase in domestic market

\[ W = [P - c]D(P) + CS(P) + [P^w - c]D^*(P^*) \]
Figure 3
Figure 3
Effect of import tariff increase from $t^* = 0$ in foreign market

$$W^* = CS^*(P^*) + [P^* - P^w]D^*(P^*)$$
Political-Economic Gov’t Preferences

- Political-economic domestic gov’t preferences:

\[ \gamma [P - c] D(P) + CS(P) + \gamma [P^* - (c + t + t^*)] D^*(P^*) + tD^*(P^*) \]

or

\[ W(P, P^*, P^w; \gamma) = \gamma [P - c] D(P) + CS(P) + \gamma [P - c] D^*(P^*) + [P^w - P] D^*(P^*) \]

- Foreign welfare same as before:

\[ W^*(P^*, P^w) = CS^*(P^*) + [P^* - P^w] D^*(P^*) \]

- Joint welfare: \( J(P, P^*; \gamma) \equiv W + W^* \) again independent of \( P^w \)

- Same proof can be used

- Political Optimum is again efficient.
Limited Instruments

- Export policies unavailable
  - PO entails zero import tariff by foreign
  - Export tariff is zero by assumption
  - So PO with no export policies entails free trade
  - But free trade is not generally efficient here

- Import Policies unavailable
  - Suppose govt’s max national welfare
  - PO import tariff is free trade, so absence is unnoticed
  - PO is efficient
  - PO would be inefficient with poli-econ pref’s though

- Upshot: Non-TOT problems might be addressed by trade agt, if govt’s are missing trade policy instruments. But then a trade agt could then supply the missing instruments and solve the remaining TOT problem.
Proposition 1

**Proposition 1:** *In the model with export sector monopoly power, and for governments with or without political-economic preferences, the only rationale for a trade agreement is to remedy the inefficient terms-of-trade driven restrictions in trade volume.*

Can extend model to have two mirror image countries that negotiate import and export policies from Nash to the PO.
DOMESTIC EXPORT MONOPOLY: SEGMENTED MARKETS

- Monopoly chooses $P$ and $P^*$ independently to maximize

$$\Pi(P, P^*, t + t^*) = [P - c]D(P) + [P^* - (c + t + t^*)]D^*(P^*)$$

- Domestic monopoly price now indep. of $t$ and $t^*$. Foreign monopoly price $P^*(t + t^*)$ is increasing function

- Domestic welfare

$$[P - c]D(P) + CS(P) + [P^* - (c + t + t^*)]D^*(P^*) + tD^*(P^*)$$

or using $P^w = P^* - t^*$

$$W(P, P^*, P^w) = [P - c]D(P) + CS(P) + [P^w - c]D^*(P^*)$$

- Foreign welfare is again

$$W^*(P^*, P^w) = CS^*(P^*) + [P^* - P^w]D^*(P^*)$$

- Joint welfare, $J(P, P^*) = W + W^*$, is indep of $P^w$
Efficiency and political optimum

- Efficiency FOC is again one independent condition on the total tariff

\[ W_P \frac{dP}{dt} + W_{P'} \frac{dP}{dt} = 0 \]

since \( P \) is now indep of tariffs.

- Politically optimal tariffs satisfy

\[ W_{P'} \frac{dP}{dt} = 0 = W_{P'} \frac{dP}{dt} \]

**Result:** Politically optimal tariffs are efficient.

- Politically optimal import policy: free trade \((P^* = P^w)\)
- Politically optimal export policy: export subsidy that delivers \(P^w = c\)

**Intuition:** No home market linkage, ignore world-price reduction effect on inframarginal units.
Figure 4
Effect of export subsidy increase in foreign market
\[ W = (P - c)D(P) + CS(P) + (P^w - c)D^*(P^*) \]
TRADE POLICIES AND PROFIT SHIFTING: INTEGRATED MARKETS

- PE model
- One domestic firm, one foreign firm
- Cournot competition
- Trade flows from domestic to foreign
- Domestic local price and demand: $P$ and $D(P)$
- Foreign local price and demand: $P^*$ and $D^*(P^*)$
- Domestic export tariff: $t$
- Foreign import tariff: $t^*$
- Integrated markets:
  \[ P^* = P + t + t^* \]
- World (offshore) price:
  \[ P^w \equiv P + t = P^* - t^* \]
Market-clearing in integrated markets

- The market-clearing condition:

\[ q + q^* = D(P) + D^*(P + t + t^*) \]

- Market-clearing prices:

\[ P(q + q^*, t + t^*) \text{ and } P^*(q + q^*, t + t^*) = P(q + q^*, t + t^*) + t + t^* \]

- Higher total tariff reduces aggregate demand, forcing lower \( P \)
- \( P \) is decreasing in \( Q \equiv q + q^* \) and \( t + t^* \), \( P^* \) is increasing in \( t + t^* \)
Cournot competition

- Domestic firm chooses $q$ to maximize

$$\Pi(q, q^*, t + t^*) = [P(q + q^*, t + t^*) - c]q$$

- Foreign firm chooses $q^*$ to maximize

$$\Pi^*(q, q^*, t + t^*) = [P^*(q + q^*, t + t^*) - c^*]q^*$$

- Cournot-Nash quantities and prices:

$$Q^N(t + t^*) = q^N(t + t^*) + q^N(t + t^*)$$

$$P^N(t + t^*) = P(Q^N(t + t^*), t + t^*)$$

$$P^{*N}(t + t^*) = P^N(t + t^*) + t + t^*$$

$$P^{wN}(t, t^*) = P^N(t + t^*) + t = P^{*N}(t + t^*) - t^*$$
Tariffs and the Cournot-Nash equilibrium

- Higher total tariff lowers mkt clearing $P$ and raises mkt clearing $P^*$, leading home firm’s reaction curve to shift in and foreign firm’s reaction curve to shift out.
- Assume $q^N(t + t^*)$ decreasing, $q^N(t + t^*)$ increasing
- Assume $P^N(t + t^*)$ decreasing, $P^N(t + t^*)$ increasing
- Then $P^{wN}(t, t^*)$ increases with $t$ and falls with $t^*$. Higher (own) tariff generates TOT gain.
- Example: increase $t$ and decrease $t^*$ keeping total tariff constant. Local prices and outputs constant. Pure rent transfer from foreign treasury to home via $P^{wN}$ increase.
Welfares as functions of prices

- In an integrated market, \( P^* - P = t + t^* \)
- True in particular at the Cournot-Nash equilibrium. Thus:
  \[
  q^N(t + t^*) = q^N(P^* - P)
  \]
  \[
  q^*N(t + t^*) = q^*N(P^* - P)
  \]

- Domestic welfare

\[
[P^N - c]D(P^N) + CS(P^N) \\
+ [P^*N - (c + t + t^*)][D^*(P^*N) - q^*N(P^*N - P^N)] \\
+ t[D^*(P^*N) - q^*N(P^*N - P^N)]
\]
Welfares as function of prices, cont.

- Domestic welfare, rewritten:

\[
W(P^N, P^*N, P^{wN}) = [P^N - c]D(P^N) + CS(P^N) \\
+ [P^{wN} - c][D^*(P^*N) - q^N(P^*N - P^N)]
\]

- Foreign welfare

\[
W^*(P^N, P^*N, P^{wN}) = [P^*N - c^*]q^N(P^*N - P^N) + CS^*(P^*N) \\
+ [P^*N - P^{wN}][D^*(P^*N) - q^N(P^*N - P^N)]
\]

- Joint welfare again independent of world price
- International externalities: local and world prices
Domestic Nash Policy

- Nash FOC for domestic government

\[
W_{P^N} \frac{dP^N}{dt} + W_{P^*N} \frac{dP^{*N}}{dt} + W_{P^wN} \frac{\partial P^wN}{\partial t} = 0
\]

- A higher export tariff \( t \) has three effects:
  - Local price changes induce volume effects (+)
    - expands domestic sales, since \( P^N \) falls
    - lowers foreign sales, since \( P^{*N} \) rises
  - Local price changes induce profit shifting effects (-)
    - higher \( P^{*N} - P^N \) lowers \( q^N \) and raises \( q^{*N} \)
    - lower domestic export volume, since \( D^* - q^{*N} \) lower
  - World price effect generates TOT gain (+)
    - a higher \( P^wN \) improves home’s TOT
Foreign Nash Policy

- Nash FOC for foreign government
  \[ W_{P^N}^* \frac{dP^N}{dt^*} + W_{P^*N}^* \frac{dP^*N}{dt^*} + W_{P^WN}^* \frac{\partial P^{wN}}{\partial t^*} = 0 \]

- A higher import tariff \( t^* \) has three effects:
  - Local price changes induce volume effects \((-\text{)}\)
    - lowers foreign sales, since \( P^*N \) rises
    - expands domestic sales, since \( P^N \) falls
  - Local price changes induce profit shifting effects \((+\text{)}\)
    - higher \( P^*N - P^N \) lowers \( q^N \) and raises \( q^*N \)
    - lower import volume, since \( D^* - q^*N \) lower
  - World price effect generates TOT gain \((+\text{)}\)
    - a lower \( P^{wN} \) improves home’s TOT
Efficient and Politically Optimal Tariffs

- Joint welfare is again independent of the world price
- For efficiency, only total tariff matters, and we have one indep FOC

$$W_{P_N} \frac{dP_N}{dt} + W_{P^*_N} \frac{dP^*_N}{dt} + W_{P_N} \frac{dP_N}{dt} + W_{P^*_N} \frac{dP^*_N}{dt} = 0$$

- The politically optimal tariff satisfy

$$W_{P_N} \frac{dP_N}{dt} + W_{P^*_N} \frac{dP^*_N}{dt} = 0$$

$$W_{P_N} \frac{dP^*_N}{dt^*} + W_{P^*_N} \frac{dP^*_N}{dt^*} = 0$$

- **Result:** Politically optimal tariffs are efficient.
Intuition

- Local price externalities associated with profit shifting exist.
- But each govt has a trade policy instrument to balance local price considerations.
- At the PO, the domestic govt balances the beneficial effect of a lower local price against the profit-shifting cost of reduced exports.
- At the PO, the foreign govt balances the profit-shifting benefit of reduced imports against the cost of a higher local price.
- Once these balances are achieved, given that prices depend only on total tariffs, local price externalities are removed.
Proposition 2

Proposition 2: *In the duopoly profit-shifting model, and for governments with or without political-economic preferences, the only rationale for a trade agreement is to remedy the inefficient terms-of-trade driven restrictions in trade volume.*

Can extend model to have two mirror image countries that negotiate import and export policies from Nash to the PO.
Linear Example (Appendix)

- Nash import tariff is positive
- Nash export policy may be positive or negative
- Politically optimal export policy is an export subsidy
- Politically optimal import tariff is positive if costs aren’t too dissimilar
- Nash tariff is inefficiently high (too little trade)
- Nash and political optimum generate same world price
- Nash Inefficiency: misallocation across foreign and domestic consumers
STRATEGIC TRADE POLICIES AND PROFIT SHIFTING

- Brander-Spencer (1985) third-market model
- Countries A and B choose export policies
- Allow for import policy in C, perhaps discriminatory
- Firms A and B compete a la Cournot
- Outputs depend on total tariffs along A-C and B-C channels
- Local A-C price wedge equals total tariff along A-C channel
- Local B-C price wedge equals total tariff along B-C channel
- Cournot outputs thus depend on local prices
Strategic Trade, cont.

*Nash policies*

- export subsidy: local price change achieves profit shifting
- but it also lowers world price along channel (TOT loss)
- Nash is inefficient: too little trade

*Political Optimum*

- as in segmented model, exporter uses export subsidy
- pushes world price down to marginal cost
- as in segmented model, importer adopts free trade
- political optimum is efficient
- lowest-cost seller takes market with price equal to cost
- Inefficiency of Nash: too little output, due to TOT
TRADE POLICIES AND PROFIT SHIFTING: SEGMENTED MARKETS

- PE model
- One domestic firm, one foreign firm
- Cournot competition
- Segmented markets: trade occurs in both directions
- Home market clearing condition determines $P$
  \[ q_h + q_f = D(P) \]
- Foreign market clearing condition determines $P^*$
  \[ q_h^* + q_f^* = D^*(P^*) \]
- Tariffs on trade flows destined for foreign market: $t_f^* + t_h^*$
- Tariffs on trade flows destined for home market: $t_f + t_h$
Figure 5
Figure 5

\[ R^N(t_h^* + t_f^*) \xrightarrow{t_h^*} P^{wN}(t_h^*, t_f^*) \xrightarrow{t_f^*} P^N(t_h^* + t_f^*) \]

\[ q_h^* \xrightarrow{t_h^*} q_h \xrightarrow{t_f} q_f^* \]

\[ P^N(t_h + t_f) \xrightarrow{t_h} P^{wN}(t_h, t_f) \xrightarrow{t_f} R^N(t_h + t_f) \]
Profit Functions and Cournot Quantities

- Home firm chooses $q_h$ and $q_h^*$ to maximize

$$\Pi^h(q_h, q_f, q_h^*, q_f^*, t_h^* + t_f^*)$$
$$= [P(q_h + q_f) - c]q_h + [P^*(q_h^* + q_f^*) - (c + t_h^* + t_f^*)]q_h^*$$

- Home reaction curves depend on $t_h^* + t_f^*$
- Foreign reaction curves depend on $t_h + t_f$
- Cournot quantities are thus

$$Q^N(t_h + t_f) = q_h^N(t_h + t_f) + q_f^N(t_h + t_f)$$
$$Q^*N(t_h^* + t_f^*) = q_h^*N(t_h^* + t_f^*) + q_f^*N(t_h^* + t_f^*)$$

- Cournot prices

$$P^N(t_h + t_f) = P(Q^N(t_h + t_f))$$
$$P^*N(t_h^* + t_f^*) = P^*(Q^*N(t_h^* + t_f^*))$$
Quantities as functions of prices

- Define world and export prices

\[
P^{*wN}(t_h, t_f) = P^N(t_h + t_f) - t_f
\]
\[
P^{wN}(t_h, t_f) = P^N(t_h + t_f) - t_h
\]
\[
R^N(t_h^* + t_f^*) = P^{*wN}(t_h^*, t_f^*) - t_h^*
\]
\[
R^{*N}(t_h + t_f) = P^{wN}(t_h, t_f) - t_f
\]

- Observe

\[
P^N - R^{*N} = t_h + t_f
\]
\[
P^{*N} - R^N = t_h^* + t_f^*
\]

- Cournot quantities

\[
Q^N(P^N - R^{*N}) = q_h^N(P^N - R^{*N}) + q_f^N(P^N - R^{*N})
\]
\[
Q^{*N}(P^{*N} - R^N) = q_h^{*N}(P^{*N} - R^N) + q_f^{*N}(P^{*N} - R^N)
\]
Welfare as functions of prices

- **Domestic welfare becomes**

\[
W(P_N, R_N, P^w_N, P^*_N, R^*_N, P^*^w_N) = [P_N^c] q_{h}^N (P_N - R_N^*) + CS(P_N) + [P^*_w N^c] q_{h}^N (P^*_N - R_N) + [P_N - P^w_N] q_{f}^N (P_N - R_N^*)
\]

- **Foreign Welfare becomes**

\[
W^*(P^*_N, R^*_N, P^*_w^N, P^*_N, R^*_N, P^*_w^N) = [P^*_N - c^*] q_{f}^N (P^*_N - R_N) + CS^*(P^*_N) + [P^*_w^N - c^*] q_{f}^N (P^*_N - R_N^*) + [P^*_N - P^*_w^N] q_{h}^N (P^*_N - R_N)
\]

- **Observe:** Joint welfare is independent of world prices
Efficient and politically optimal policies

- Now proceed as before
- Define joint welfare, now $J(P^N, R^N, P^*N, R^*N) = W + W^*$
- Derive 2 FOCs for efficiency (one for each channel)
- Derive 4 FOCs for political optimality
- Local prices on a trade channel depend only on the sum of tariffs along that channel
- Confirm that politically optimal policies are efficient
- Proposition 2 extends to segmented markets
TRADE POLICIES AND DELOCATION; SEGMENTED MARKETS

- Generalize model to allow for \( n_h \) domestic and \( n_f \) foreign firms
- Get Cournot expressions of form:

\[
Q^N(n_h, n_f, t_h + t_f) = n_h q^N_h(n_h, n_f, t_h + t_f) + n_f q^N_f(n_h, n_f, t_h + t_f)
\]

\[
Q^N_*(n_h, n_f, t_h^* + t_f^*) = n_h q^N_h^*(n_h, n_f, t_h^* + t_f^*) + n_f q^N_f^*(n_h, n_f, t_h^* + t_f^*)
\]

- Derive maximized firm profit over the two markets
- Assume fixed cost \( F > 0 \) of entry per firm
- Choose \( n_h \) and \( n_f \) to deliver zero profits
- Express as \( n_h^N(t_h + t_f, t_h^* + t_f^*) \) and \( n_f^N(t_h + t_f, t_h^* + t_f^*) \)
- Now all quantities and local prices are functions of \( t_h + t_f \) and \( t_h^* + t_f^* \).
Welfare functions in free entry model

- Domestic welfare: \( CS(P^N) + t_h n^N_f q^N_f + t_h^* n^N_h q^N_h \)
- Total tariffs again can be expressed as local price wedges
- Can thus express domestic imports and exports as

\[
M(P^N, R^N, P^*N, R^*N) = n^N_f(\cdot)q^N_f(\cdot)
\]

\[
E(P^N, R^N, P^*N, R^*N) = n^N_h(\cdot)q^N_h(\cdot)
\]

where dots are \( t_h + t_f = P^N - R^*N \) and \( t_h^* + t_f^* = P^*N - R^N \)

- Using dots for the four local prices, welfares are thus

\[
W(P^N, R^N, P^wN, P^*N, R^*N, P^*wN) = CS(P^N) + [P^N - P^wN]M(\cdot) + [P^*wN - R^N]E(\cdot)
\]

and

\[
\]
Efficient and politically optimal policies

- Now proceed as before
- Define joint welfare, now \( J(P^N, R^N, P^N, R^N) = W + W^* \)
- Derive 2 FOCs for efficiency (one for each channel)
- Derive 4 FOCs for political optimality
- Local prices on a trade channel depend only on the sum of tariffs along that channel
- Confirm that politically optimal policies are efficient
Proposition 3

Proposition 3: In the segmented-markets Cournot model of firm delocation, the only rationale for a trade agreement is to remedy the inefficient terms-of-trade driven restrictions in trade volume.

Can extend model to have two mirror image countries that negotiate import and export policies from Nash to the PO.
INTEGRATED MARKETS AND MONOPOLISTIC COMPETITION

- Model: Helpman-Krugman version of Venables (87)
- Two countries, labor endowments and only factor
- Utilities
  \[ U = \theta^{-1} C^\theta + C_Y \] \[ U^* = \theta^{-1} (C^*)^\theta + C_Y^* \]
- \( C \) is index of cons of basket of diff’ed goods (composite good \( D \))
- \( C_Y \) is cons of homogeneous good \( Y \), produced 1-for-1 by labor
- \( Y \) is traded and produced in each country, normalize price to unity
- \( P \) and \( P^* \) denote local prices of \( D \) and \( D^* \)
- \( 0 < \theta < 1 \)
- Demand for good \( D \) at home: \( C = P^{-\epsilon} \), where \( \epsilon = 1/(1 - \theta) \) is demand elasticity
- Indirect utility function for home, \( V(P, I) \), where \( I \) is domestic income
Assume $C$ has CES form:

$$C = \left[\sum (c^i)^\alpha\right]^{1/\alpha}$$

where $c^i$ is domestic conspt of variety $i$ and $0 < \alpha < 1$

Associated price index

$$P = \left[\left(\sum p^i\right)^{\alpha/\alpha - 1}\right]^{\alpha - 1/\alpha}$$

Domestic demand for variety $i$:

$$c^i = C \cdot \left(\frac{p^i}{P}\right)^{-\sigma}$$

Thus

$$c^i = (p^i)^{-\sigma} P^{\sigma - \epsilon} \equiv c^i(p^i, P)$$

Foreign demand $c^{*i}(p^{*i}, P^*)$ is similar
• Production technology: marginal cost $c$ and fixed cost $F$
• iceberg transport cost: $\phi > 0$
• allow ad valorem import and export tariffs.
• home good exported to foreign: $\tau_f^*$ and $\tau_h^*$
• foreign good exported to home: $\tau_h$ and $\tau_f$
• integrated markets: local price wedges are functions of total tariff along channel and iceberg cost:

\[
\begin{align*}
    p_{h}^{*i} & = (1 + \phi + \tau_h^* + \tau_f^*) p_{h}^i \\
    p_{f}^{i} & = (1 + \phi + \tau_f + \tau_h) p_{f}^{*i}
\end{align*}
\]
Monopoly prices

Taking $P$ and $P^*$ as given, firm $i$ sets price $p^i_h$ to maximize profit

$$\pi^i = (p^i_h - c)[c^i(p^i_h, P) + c(p^*_i, P^*)] - F$$

Monopoly price is:

$$p^i_h = \frac{\sigma}{\sigma - 1} c \equiv \hat{p}$$

Let

$$p^*_h = (1 + \phi + \tau^*_h + \tau^*_f)\hat{p} \equiv p^*_h(\phi + \tau^*_h + \tau^*_f)$$

Similarly,

$$p^*_i = \frac{\sigma}{\sigma - 1} c \equiv \hat{p}$$

and

$$p_f = (1 + \phi + \tau_f + \tau_h)\hat{p} \equiv p_f(\phi + \tau_f + \tau_h)$$
Prices indices, free entry and income

Given $n_h$ domestic firms and $n_f$ foreign firms, price indices thus have form

$$P(n_h, n_f, \phi + \tau_f + \tau_h)$$

and

$$P^*(n_h, n_f, \phi + \tau^*_h + \tau^*_f)$$

Free entry then determines $n_h$ and $n_f$ as

$$n_h(\phi + \tau_f + \tau_h, \phi + \tau^*_h + \tau^*_f)$$

and

$$n_f(\phi + \tau_f + \tau_h, \phi + \tau^*_h + \tau^*_f)$$

Can now express income as labor income ($w = 1$) plus tariff revenue:

$$I = L + \tau^*_h \hat{p}n_h(\cdot, \cdot)c^*(p^*_h(\cdot), P^*(\cdot, \cdot))$$

$$+ \tau_h \hat{p}n_f(\cdot, \cdot)c(p_f(\cdot), P(\cdot, \cdot))$$

and

$$I^* = L^* + \tau_f \hat{p}n_f(\cdot, \cdot)c(p_f(\cdot), P(\cdot, \cdot))$$

$$+ \tau^*_f \hat{p}n_h(\cdot, \cdot)c^*(p^*_h(\cdot), P^*(\cdot, \cdot))$$
World prices and income

- World price for exports to foreign market: \( p^w = (1 + \tau_h^*)\hat{p} \)
- World price for exports to domestic market: \( p^w = (1 + \tau_f^*)\hat{p} \)
- Note: \( \tau_h^*\hat{p} = p^w - \hat{p} \) and \( \tau_f^*\hat{p} = p^w - \hat{p} \)
- Substitutions of this kind yield income expressions of form:

\[
I = I(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), p^w(\tau_f), p^{*w}(\tau_h^*), n_h(\cdot, \cdot), n_f(\cdot, \cdot))
\]

\[
I^* = I^*(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), p^w(\tau_f), p^{*w}(\tau_h^*), n_h(\cdot, \cdot), n_f(\cdot, \cdot))
\]

- Indirect utilities now take form

\[
V(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), p^w(\tau_f), p^{*w}(\tau_h^*), n_h(\cdot, \cdot), n_f(\cdot, \cdot))
= (\epsilon\theta)^{-1}[P(\cdot, \cdot)]^{-\epsilon\theta} + I(\cdot, \cdot, \tau_f, \tau_h^*)
\]

and

\[
V^*(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), p^w(\tau_f), p^{*w}(\tau_h^*), n_h(\cdot, \cdot), n_f(\cdot, \cdot))
= (\epsilon\theta)^{-1}[P^*(\cdot, \cdot)]^{-\epsilon\theta} + I^*(\cdot, \cdot, \tau_f, \tau_h^*)
\]
Local prices and the terms of trade

- Local prices and price indices and numbers of firms all depend on total tariffs: $\tau_f + \tau_h$ and $\tau^*_h + \tau^*_f$

- But world prices satisfy

$$\frac{dp^*_w}{d\tau_h} = 0 = \frac{dp^*_w}{d\tau^*_f}$$
$$\frac{dp^*_w}{d\tau^*_h} = \hat{\rho} = \frac{dp^*_w}{d\tau_f}$$

- Neither country can alter TOT with import tariff (marginal cost tied down by free trade in $Y$, and CES demand implies firm’s price markup is insensitive to ad valorem trade taxes)

- But each country can alter TOT with its export tariff - and to an extreme degree.
Efficient tariffs

Efficient tariffs maximize $V + V^*$

Substitutions imply world prices cancel from joint income:

$$I + I^* = K(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), n_h(\cdot, \cdot), n_f(\cdot, \cdot)).$$

Thus

$$V + V^* = (\epsilon \theta)^{-1} [P(\cdot, \cdot)]^{-\epsilon \theta} + (\epsilon \theta)^{-1} [P^*(\cdot, \cdot)]^{-\epsilon \theta} + K(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), n_h(\cdot, \cdot), n_f(\cdot, \cdot)).$$

$$\equiv G(P(\cdot, \cdot), P^*(\cdot, \cdot), p^*_h(\cdot), p_f(\cdot), n_h(\cdot, \cdot), n_f(\cdot, \cdot)).$$

Joint welfare is thus a function of total tariffs: $\tau_f + \tau_h$ and $\tau^*_f + \tau^*_h$

2 FOCs for efficiency, as before
Politically optimal tariffs and Proposition 4

- If govt's act as if $V_{p^w} \equiv 0 \equiv V_{p^{*w}}$ and similarly for $V^*$, then 4 FOCs for PO
- **Result:** Politically optimal tariffs are efficient

**Proposition 4:** In the integrated-markets monopolistic competition model of firm delocation, the only rationale for a trade agreement is to remedy the inefficient terms-of-trade driven restrictions in trade volume.
Intuition

- Import tariff can delocate foreign firms and lower domestic price index.
- They also lower trade volume from those that remain, but no TOT effect.
- An export subsidy can delocate foreign firms and lower domestic price index.
- But an export subsidy worsens the domestic TOT.
- An export subsidy could be set to neutralize any delocation or export volume reduction attributable to trading partner’s import tariff.
- If a country ignores its TOT, it will use an export subsidy in just this way.
Limited Instruments

- If only import tariffs available, no TOT effect
- Efficiency defined in same way (redundancy)
- Politically optimal import tariffs are same as Nash (no TOT effects)
- Politically optimal import tariffs are inefficient (firm delocation)
- But problem is due to missing instruments

Ossa

- Ossa: More general model allowing for income effects, and thus abstracts form tariff revenue.
- Ossa: Leads him to ignore export policies
- We can handle tariff revenue, export policies in quasi-linear setting, and find that a full set of trade policies is crucial.
CONCLUSION

- Trade Agreements and Imperfect Competition
  - Step 1: Why are noncooperative policies inefficient?
  - Step 2: How should a trade agreement be designed?
  - We focus here on Step 1

- Main finding: When markets are imperfectly competitive and governments have sufficient trade policy instruments, noncooperative policies are inefficient iff governments are motivated by the terms of trade consequences of their trade policy decisions.

- Next up: work on Step 2.