Trade Policy I: *Background and Preliminaries*

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Instruments of Trade Policy

- In this lecture, we will focus on 3 trade policy instruments
  1. **Import taxes**: distort import prices and generate revenue.
  2. **Export taxes**: distort import prices and generate revenue.
  3. **Non-Revenue trade barriers**: distort prices without raising revenue.

- Governments also use other trade policy instruments: *anti-dumping duties, import quotas, local content requirements*, etc.

- Some of these alternative instruments can be mimicked with import/export taxes or NRTBs.
What Motivates the Use of Trade Policy?

- Governments can use trade policy instruments for
  - **Terms-of-trade motives**: exploiting national-level market power w.r.t. the rest of the world.
  - **Political motives**: redistributing surplus from others to exporting or import-competing firms.

- Trade policy instruments can also be used as a *second-best* tool to
  - Improve allocative inefficiency
  - reduce income/consumption inequality
  - generate revenue for the government
Outline of This Lecture

- Characterize the optimal trade policy in a multi-industry perfectly competitive trade model à la Armington or EK:
  - the governments maximizes social welfare $\implies$ no political motives
  - there is a representative consumer $\implies$ no inequality-reducing motives.
  - markets are efficient $\implies$ no corrective motives for policy.

- In this set-up, the only motive for using trade policy is to improve the terms-of-trade w.r.t. the rest of the world.
Some Background

- The textbook models of trade policy are
  1. partial equilibrium models with homogeneous goods
  2. feature industry-specific factors of production

- The class of models covered in this class are
  1. general equilibrium models w/ differentiated goods
  2. typically feature one factor of production

- Hence, the optimal policy results presented in this lecture will look fundamentally different from the textbook case (I will try to elaborate on these differences whenever possible).
Theoretical Framework
Environment

- Two countries: Home (h) and Foreign (f)
- Many industries: \( k = 1, \ldots, K \)
- Labor is the sole factor of production
- Each country \( i \) is populated with \( L_i \) units of labor.
- Workers are perfectly mobile across industries but immobile across countries.
Preferences and Demand

Representative consumer’s utility in country $i \in \{h, f\}$

$$U_i(Q_{hi}, Q_{fi}) = \prod_{k=1}^{K} (Q_{hi,k} + Q_{fi,k}^\rho \frac{e_{i,k}}{\rho_k})$$

- goods are differentiated by country of origin.
- “$ji, k$” indexes exporter $j \times importer i \times industry k$
- $Q_{ji} = \{Q_{ji,1}, ..., Q_{ji,k}\}$
- $\sum_{k=1}^{K} e_{i,k} = 1$
Preferences and Demand

- Representative consumer’s problem

\[ V_i(\tilde{P}_i, Y_i) \equiv \max_{Q_i} U_i(Q_{hi}, Q_{fi}) \quad \text{(CP)} \]

\[ \text{s.t. } \sum_{k \in K} (\tilde{P}_{hi,k} Q_{hi,k} + \tilde{P}_{fi,k} Q_{fi,k}) = Y_i \]

- Marshallian demand function implied by CP (\( \epsilon = 1/\rho - 1 \)):

\[ Q_{ji,k} = \mathcal{D}_{ji,k}(\tilde{P}_i, Y_i) \equiv \frac{\tilde{p}^{1-\epsilon_k}}{\sum_{j=h,f} \tilde{p}_{li,k}^{\epsilon_k}} e_{i,k} Y_i \]

- \( \tilde{p}_{ji,k} \) denotes the “consumer” price, which can be different from the “producer” price, \( p_{ji,k} \), due to trade taxes.
Supply-Side of the Economy

Perfectly competitive price:

\[ P_{ji,k}(w_j) = \tau_{ji,k} a_{j,k} \times w_j \]

- Key assumption: the unit labor cost, \( a_{j,k} \tau_{ji,k} \), is invariant to policy.
- Trade policy affects producer prices only through the wage rate, \( w_j \).
- The above assumption will be violated if we allow for (i) IO linkages, (ii) multiple factors of production, or (iii) increasing returns to scale.
Instruments of Trade Policy

- Trade policy instruments:
  1. import tax-cum-subsidies \((t_{ji,k})\)
  2. export tax-cum-subsidies \((x_{ji,k})\)
  3. non-revenue trade barriers or NRTBs \((T_{ji,k})\)

- These instruments create a wedge between producer and consumer prices:

\[
\tilde{P}_{ji,k} = T_{ji,k} (1 + t_{ji,k}) (1 + x_{ji,k}) P_{ji,k}
\]

- Import and export taxes raise revenue for the imposing government:

\[
R_i \equiv \sum_{k,j \neq i} \left[ t_{ji,k} (1 + x_{ji,k}) P_{ji,k} Q_{ji,k} + x_{ij,k} P_{ji,k} Q_{ji,k} \right]
\]
Expressing Eq. Outcomes in terms of Taxes and Wages

– It’s never optimal to use NRTBs in the presence of trade taxes ⇒ we can temporarily abstract from NRTBs.

– We can, thus, express all equilibrium variables in terms of trade taxes, \( t \equiv \{t_{ji,k}\} \) and \( x \equiv \{x_{ji,k}\} \), as well was wages \( w \equiv \{w_i\} \).

– Equilibrium consumption/output levels can be determined by plugging \( \tilde{P}_{ji,k} \) into the CES demand function:

\[
Q_{ji,k}(t, x; w) = D(\tilde{P}_i(t, x; w), Y_i(t, x; w))
\]

where

\[
Y_i(t, x; w) = w_iL_i + \underbrace{R_i(t, x; w)}_{\text{Tariff Revenue}}
\]
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- Equilibrium consumption/output levels can be determined by plugging \( \tilde{p}_{ji,k} \) into the CES demand function:

\[
Q_{ji,k}(t, x; \mathbf{w}) = \frac{[\left(1 + t_{ji,k}\right)\left(1 + x_{ji,k}\right) \tau_{ji,k}a_{j,k}w_j]^{-\epsilon_k-1}}{\sum_{j=h,f}[\left(1 + t_{ji,k}\right)\left(1 + x_{ji,k}\right) \tau_{ji,k}a_{j,k}w_j]^{-\epsilon_k}} \ e_{i,k}Y_i(t, x; \mathbf{w})
\]

where

\[
Y_i(t, x; \mathbf{w}) = w_iL_i + \underbrace{R_i(t, x; \mathbf{w})}_{\text{Tariff Revenue}}
\]
Equilibrium: Definition

- For a given vector of taxes, $t$ and $x$, equilibrium is a vector of wages, $w$, that satisfy the *balanced trade* condition:

$$\sum_{k=1}^{K} (1 + x_{fh,k}) P_{fh,k}(w_f) Q_{fh,k}(t, x; w) = \sum_{k=1}^{K} (1 + x_{hf,k}) P_{hf,k}(w_h) Q_{hf,k}(t, x; w)$$

- A policy-wage $(t, x; w)$ combination is, therefore, *feasible* if $w$ satisfies the *balanced trade* condition, given $t$ and $x$.

- $\mathcal{F}$ denotes the set of all the feasible policy-wage combinations.
Cooperative Optimal Policy
Throughout this lecture we assume that the government maximizes social welfare as defined below:

$$W_i(t, x; w) \equiv V(Y_i(t, x; w), \tilde{P}_i(t, x; w))$$
Government’s Objective Function

- Throughout this lecture we assume that the government maximizes social welfare as defined below (Cobb-Douglas-CES preferences):

\[
W_i(t, x; w) \equiv \frac{Y_i(t, x; w)}{\prod_{k=1}^{K} \tilde{p}_{i,k}(t, x; w)^{e_{i,k}}}
\]

- The above assumption rules out political motives for taxing imports or exports.
Optimal Cooperative Policy

- The optimal *cooperative* policy is a solution to \( \alpha \equiv L_h / (L_h + L_f) \)

\[
\max_{(t,x;w) \in F} \alpha W_h(t, x; w) + (1 - \alpha) W_f(t, x; w) \quad \text{(P1)}
\]

- The solution to (P1) is zero trade taxes: \( t^* = x^* = 0 \)

- The above result is due to the economy being efficient.

- If there are pre-existing distortions (like environmental externalities or market power) trade taxes can be used as a *second-best* policy to correct these distortions.
Non-Cooperative Optimal Policy
Simplifying the Notation

- **Assumption:** only Home imposes taxes
  - $t_{hf,k} = x_{fh,k} = 0$
  - $t_k \equiv t_{fh,k}; \ x_k \equiv x_{hf,k}$

- Assign Foreign labor as the numeraire ($w_f = 1$) $\implies$ welfare can be expressed as a function of only $w_h$:

  $$W_i(t, x; w_h) \equiv V(Y_i(t, x; w_h), \tilde{P}_i(t, x; w_h))$$

- Since Foreign is passive, $t \equiv \{t_k\}$, and $x \equiv \{x_k\}$, hereafter, denote Home’s policy instruments only.
Optimal Trade Policy Problem

- Home’s optimal non-cooperative policy is a solution to

\[
\max_{t, x} \ W_h(t, x; w_h) \quad (P2)
\]

\[
s.t. \quad \sum_{k=1}^{K} P_{fh,k}(.) Q_{fh,k}(.) = \sum_{k=1}^{K} (1 + x_k) P_{hf,k}(.) Q_{hf,k}(.)
\]

- The label non-cooperative is due to (P2) not internalizing the effect of trade taxes on Foreign’s welfare.
Optimal Trade Policy Problem

- Home’s optimal non-cooperative policy is a solution to

$$\max_{(t,x;w_h) \in F} W_h(t, x; w_h) \quad (P2)$$

- The label non-cooperative is due to (P2) not internalizing the effect of trade taxes on Foreign’s welfare.
An Intermediate Result: *The Lerner Symmetry*

- Before solving (P2), I present an intermediate result that simplifies the aforementioned task.

- This result is generally known as the **Lerner symmetry**.

- In simple words, the Lerner symmetry posits that an across-the-board tax on exports is equivalent to an across-the-board tax on imports.
Statement of the Lerner Symmetry

Consider the following two policy schedules ($\delta \in \mathbb{R}_+$):

\[
P = \begin{cases} 
1 + t = (1 + t_1, \ldots, 1 + t_K) \\
1 + x = (1 + x_1, \ldots, 1 + x_K)
\end{cases} \quad ; \quad P' = \begin{cases} 
1 + t' = (\delta(1 + t_1), \ldots, \delta(1 + t_K)) \\
1 + x' = ((1 + x_1)/\delta, \ldots, (1 + x_K)/\delta)
\end{cases}
\]

The Lerner Symmetry Theorem:

1. If $(t, x; w_h)$ is a feasible combination $\implies (t', x'; \delta w_h)$ is also feasible.

2. Policy schedules $P$ and $P'$ are equivalent from a welfare standpoint

\[W_h(t, x; w_h) = W_h(x', t'; \delta w_h)\]
Proof of the Lerner Symmetry

– Demand is homogeneous of degree zero

\[ \mathcal{D}_{ji,k}(\delta \tilde{P}_i, \delta Y_i) = \mathcal{D}_{ji,k}(\tilde{P}_i, Y_i) \]

– The above property yields **Claim 1:**

\[ \begin{align*}
\tilde{P}'_h &= \delta \tilde{P}_h; \quad Y'_h = \delta Y_h \\
\tilde{P}'_f &= \tilde{P}_f \quad Y'_f = Y_f = L_f
\end{align*} \implies Q'_{ji,k} = Q_{ji,k} \quad \forall ji, k \]
Proof of the Lerner Symmetry

- Claim 2:

\[
Q'_{ji,k} = Q_{ji,k} \forall ji, k \implies \begin{cases} 
\tilde{P}'_h = \delta \tilde{P}_h; & Y'_h = \delta Y_h \\
\tilde{P}'_f = \tilde{P}_f & Y'_f = Y_f = L_f
\end{cases}
\]

- The fact that \(Y'_h = \delta Y_h\) can be shown as follows:

- \(R'_i = \sum_k (\delta [t_k + 1] - 1) P_{fh,k} Q'_{fh,k} + ([1 + x_k] / \delta - 1) \delta P_{hf,k} Q'_{hf,k})\)

- Combining the (i) balanced trade condition, (ii) \(Q'_{ji,k} = Q_{ji,k}\), and (iii) the above equation yields the following

\[
R'_i = \delta \sum_k (t_k P_{fh,k} Q_{fh,k} + x_k P_{hf,k} Q_{hf,k}) = \delta R_i
\]

- The above equation implies that \(Y'_h = \delta w_h L_h + R'_i = \delta Y_h\).
Proof of the Lerner Symmetry

- **Claim 1 + Claim 2** prove the first part of the theorem.

- The second part follows immediately from the fact that the indirect utility is also homogeneous of degree zero:

\[
V_h(\tilde{P}_h, Y_h) = V_h(\delta \tilde{P}_h, \delta Y_h) = V_h(\tilde{P}_h, Y_h)
\]
Proof of the Lerner Symmetry

- **Claim 1 + Claim 2** prove the first part of the theorem.

- The second part follows immediately from the fact the the indirect utility is also homogeneous of degree zero:

\[
V_h(\tilde{P}_h', Y_h') = V_h(\delta \tilde{P}_h, \delta Y_h) = V_h(\tilde{P}_h, Y_h)
\]

- **Key implication of the Lerner Symmetry:** there are multiple optimal trade tax schedules!
The Optimal Policy Schedule

**Theorem** [Beshkar & Lashkaripour, 2019] Home’s optimal non-cooperative policy consists of a uniform tariff, $\bar{t}$, and industry-specific export taxes:

$$1 + t^*_k = 1 + \bar{t}$$

$$(1 + x^*_k)(1 + \bar{t}) = \frac{\text{demand elasticity}_{hf,k}}{\text{demand elasticity}_{hf,k} - 1}$$
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$$1 + t_k^* = 1 + \bar{t}$$

$$\left(1 + x_k^*\right) \left(1 + \bar{t}\right) = 1 + \frac{1}{\epsilon_k \lambda_{ff,k}}$$

- Following the Lerner symmetry, $\bar{t}$ can be any arbitrary number (e.g., the optimal policy may include an import subsidy, $\bar{t} < 0$, paired with a high export tax)
- $x_k^*$ is an optimal monopoly markup charged on the Rest of the World ($\lambda_{ff,k} = \tilde{P}_{ff,k} Q_{ff,k}/e_{f,k} Y_f$).
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Closing Remarks

- Home’s optimal non-cooperative policy worsens Foreign’s welfare.

- In fact, global welfare drops after the imposition of $t^*$ and $x^*$

$$\alpha \Delta W_h + (1 - \alpha) \Delta W_f < 0.$$  

- That is because Home distorts global production/consumption to transfer surplus from the RoW to its consumers (ToT manipulation).

- In the next lecture, I will sketch out the proof of the previous theorem.