

The New Trade Theory

Monopoly and oligopoly in trade

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Topic 3

A new generation of models

Main characteristics and insights:

- ▶ Countries do not trade, **firms** do.
- ▶ Insights from Grubel and Lloyd (1975) analysis [new international data]
 - ▶ Trade volumes are largely dominated by trade between similar countries
 - ▶ Trade volumes are largely dominated by trade in similar goods
 - ▶ this is at odds with comparative advantage theory
- ▶ New models of imperfect competition in the IO literature
 - ▶ Strategic interactions [oligopoly models]
 - ▶ Product differentiation [monopolistic competition]
 - ▶ Demand: ideal and love of varieties [Dixit-Stiglitz utility function]
- ▶ A **new view** and **new gains from trade**.

Part I

Monopoly

Monopoly

The frame: one firm producing as a monopolist in the domestic market

- ▶ Assume we are in autarky.
- ▶ One good X , with price p , total cost $c(x)$, marginal cost $c'(x)$ where x is the quantity produced by the single firm.
- ▶ There are m consumers having an individual demand function $D(p)$.
- ▶ Assume: (1) $c(x) = c \cdot x$, this implies that $\frac{c(x)}{x} = c'(x) = c > 0$: constant returns to scale; (2) the price elasticity of demand is $\sigma > 1$
- ▶ Under monopoly $x \equiv X$ and aggregate demand is $X = m \cdot D(p)$.

Monopoly (2)

- ▶ The monopolist firm maximizes profits (it can choose either p or X)

$$\Pi(X) = p(X) \cdot X - c \cdot X$$

where $p(X) = D^{-1}(\frac{X}{m})$ is the inverse demand function.

- ▶ From the first order condition:

$$\frac{d\Pi(X)}{dX} = [dp(X)/dX] \cdot X + p(X) - c = p'(X) \cdot X + p(X) - c = 0.$$

- ▶ In perfect competition: $p'(X) = 0$ (perfectly elastic [horizontal] demand) $\Rightarrow p_C = p(X) \equiv c$.
- ▶ Under monopoly there is a price (and quantity) distortion

Monopoly (3)

The monopoly distortion (Proof)

- ▶ Write the first order condition as:

$$\begin{aligned}\frac{d\Pi(X)}{dX} &= p'(X) \cdot X + p(X) - c = p(X)\left[1 + \frac{p'(X) \cdot X}{p(X)}\right] - c = \\ &= p(X)\left[1 - \frac{1}{\sigma}\right] - c = 0.\end{aligned}$$

- ▶ Therefore

$$p_M = p(X) \equiv \frac{\sigma}{\sigma - 1} \cdot c \quad (1)$$

- ▶ From equation 1 we know that the monopolist set a *mark-up* on c , and that the mark-up is fixed and proportional to σ .
- ▶ Since $\sigma > 1 \Rightarrow \frac{\sigma}{\sigma-1} > 1 \Rightarrow p_M > c = p_C$
- ▶ therefore $p_M - c = \frac{c}{\sigma-1}$ indicates that the distortion is reduced as $\sigma \rightarrow \infty$.

Monopoly and trade

- ▶ Introducing trade (market integration vs market segmentation)
- ▶ Trade means more elastic demand (the horizontal sum of two demand functions) and more competitive market.
- ▶ Gains from trade are related to the induced competition (expressed by $\sigma \uparrow$) in a former monopolist market: this is the **pro-competitive effect** of trade.
- ▶ Do countries trade? If they are identical ($m = m^*$ with one monopoly firm for each country) **no!**
- ▶ The **perception** of a more open market is sufficient to induce a more pro-competitive attitude (contestable market theory), but trade will not take place.

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Part II

Oligopoly

Oligopoly without strategies: the Markusen (1981) model

- ▶ Each country is composed of n identical firms producing a homogeneous good X ($X = n \cdot x$).
- ▶ Conditions (costs, demand ($p(X) = D^{-1}(X/m)$ from the equilibrium condition), constant returns to scale) are the same as in the monopoly model.
- ▶ Every firm is a **Cournot player** (chooses x taking as given the quantity chosen by the other $n - 1$ players: $(n - 1) \cdot \frac{X}{n}$).
- ▶ The f.o.c. for profit maximization is:

$$\frac{d\Pi(X)}{dx} = [dp(X)/dx] \cdot x + p(X) - c = 0.$$

- ▶ Since $X = x + (n - 1) \cdot \frac{X}{n}$, $dX/dx = 1$ and $dp(X)/dx = \frac{p'(X)}{m}$.
- ▶ we can write

$$c = p(X) \left[1 + \frac{p'(X) \cdot x}{p(X) \cdot m} \right] = p(X) \left[1 + \frac{p'(X) \cdot X \cdot x}{p(X) \cdot m \cdot X} \right].$$

The Markusen (1981) model (2)

- ▶ All the previous algebra boils down to

$$c = p(X) \left[1 - \frac{1}{\sigma} \cdot \frac{1}{n} \right].$$

- ▶ And the core equation is

$$p_O = p(X) \equiv \frac{n \cdot \sigma}{n \cdot \sigma - 1} \cdot c. \quad (2)$$

- ▶ What is the effect of trade?
- ▶ Markets are now integrated. Comparative static exercise on σ and n .
- ▶ Interaction effect of n and σ (perceived elasticity $\sigma \cdot n$ vs true elasticity σ).
- ▶ Welfare conclusions are the same as in monopoly: there is a **pro-competitive effect** of trade due to σ , n and $\sigma \times n$.

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The Markusen (1981) model (3)

- ▶ Do countries trade?
- ▶ If they are identical ($m = m^*$ and $n = n^*$) **no!**
- ▶ Trade: **impose asymmetry** $\Rightarrow m > m^*$ (the home country's market is larger).
 - ▶ Trade: introduce an other good (produced under perfect competition).
 - ▶ Trade: the larger country imports the oligopolistic good and export the competitive good.
- ▶ Trade: **impose asymmetry** $\Rightarrow n > n^*$ (the home country's market is more competitive)
 - ▶ Trade: the more competitive country exports the oligopolistic good and import the competitive good.

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Strategic Oligopolists: the Brander-Krugman (1983) model

- ▶ In the Markusen (1981) model markets were perfectly integrated and strategic interaction is hidden.
- ▶ What if markets are still partially segmented (trade impediments, distance, protectionism) and the role of strategic interaction is highlighted? This is what the Brander-Krugman (1983) model is about.
- ▶ **The setup:** Two countries, H and F ; one firm for each country; one homogeneous good (the H firm sells x on the H market and x^* on the F market, the F firm sells y on the H market and y^* on the F market); costs and demand are as usual.
- ▶ Trade is limited by **transport costs**: Iceberg costs (of every quantity sent abroad only a portion $\tau \in [0, 1]$ arrives, the rest $(1 - \tau)$ is melt away). What if $\tau = 0$?

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The Brander-Krugman (1983) model (2)

- ▶ Market segmentation implies that the two markets can be separately analyzed.

“The main idea of the model is that each firm regards each country as a separate market and therefore chooses the profit-maximizing quantity for each country separately.”

- ▶ Every firm is a **Cournot player** (chooses x taking as given the quantity y chosen by the other player) and is a profit maximizer.
- ▶ The profit function is

$$\Pi_X(x, x^*) = p(x + y) \cdot x + p^*(x^* + y^*) \cdot \tau \cdot x^* - c(x + x^*)$$

- ▶ The f.o.c. for profit maximization of the H firm in the H market is:

$$\frac{d\Pi_X(x, x^*)}{dx} = p'(x + y) \cdot x + p(x + y) - c = 0.$$

The profit-maximizing choice of x is independent of x^* and similarly for y and y^* : each country can be considered separately.

- ▶ If we define $s \equiv \frac{x}{x+y}$, we can write:

$$c = p(x + y) \left[1 + \frac{p'(x+y) \cdot x}{p(x+y)} \right] = p(x + y) \left[1 - \frac{s}{\sigma} \right].$$

The Brander-Krugman (1983) model (3)

- ▶ The **reaction function** of the H firm is:

$$c = p(x + y) \left[1 - \frac{s}{\sigma}\right],$$

- ▶ the meaning of best response: dominant strategy.
- ▶ (digression) best responses in Cournot and Bertrand games: **strategic substitutes and strategic complements**.
- ▶ (digression 2) the **Herfindahl Index**: $\mathcal{H} \equiv \sum_{i=1}^n s_i^2$

- ▶ The reaction function of the H firm can be written as:

$$p(x + y) - c = \left[\frac{s}{\sigma}\right] \cdot p(x + y).$$

- ▶ Analyzing only the H market (as if for firm H $\tau_H = 0$ and for firm F $\tau_F = 1$),

$$\Pi_X = x \cdot (p(x + y) - c) = x \cdot \left[\frac{s}{\sigma}\right] \cdot p(x + y),$$

we can sum the profits for all firms

$$\begin{aligned} \sum_{i=x,y} \Pi_i &= \sum_{i=x,y} q_i\left(\left[\frac{s_i}{\sigma}\right]\right) \cdot p(x + y), \\ \frac{\sum_{i=x,y} \Pi_i}{X \cdot p(x+y)} &= \sum_{i=x,y} \frac{q_i}{X}\left(\left[\frac{s_i}{\sigma}\right]\right) = \sum_{i=x,y} s_i^2 \left[\frac{1}{\sigma}\right] = \mathcal{H} \left[\frac{1}{\sigma}\right], \end{aligned}$$

The Brander-Krugman (1983) model (4)

- For the F firm

$$\Pi_Y(y, y^*) = p(x + y) \cdot \tau \cdot y + p^*(x^* + y^*) \cdot y^* - c(y + y^*)$$

- and the f.o.c. for a max in the H market is

$$\frac{d\Pi_Y(y, y^*)}{dy} = p'(x + y) \cdot \tau \cdot y + p(x + y) \cdot \tau - c = 0.$$

- and the reaction function of the F firm is:

$$c = \tau \cdot p(x + y) \left[1 - \frac{(1 - s)}{\sigma} \right]. \quad (3)$$

Together with the reaction function of the H firm is the core of the B-K model

$$c = p(x + y) \left[1 - \frac{s}{\sigma} \right], \quad (4)$$

- Solve the system of equations and obtain s and $p(x + y)$

The Brander-Krugman (1983) model (5)

- Solve for s

$$s = \frac{\tau + (1 - \tau) \cdot \sigma}{1 + \tau},$$

- and substitute in one of the two reaction functions

$$p(x + y) = \frac{c \cdot \sigma (1 + \tau)}{\tau \cdot (2\sigma - 1)},$$

- Analysis:

- Both s and $(1 - s)$ are positive if $\sigma > \frac{\tau}{\tau - 1}$, which is the condition for $p > c$.
- Trade takes place in segmented markets ($0 < \tau < 1$) even between identical countries trading a homogeneous goods (Intra-industry trade).
- Is trade beneficial? Yes (Pro-competitive effect) and no (consumers pay for the transportation cost).

The Brander-Krugman (1983) model (6)

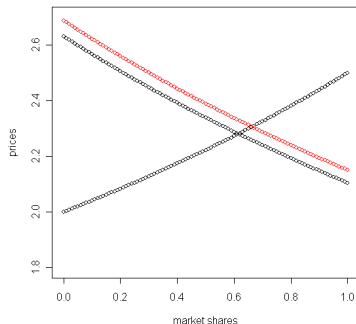
► Comments:

- At equilibrium, each firm has a smaller market share of its export market than of its domestic market. Therefore, perceived marginal revenue is higher in the export market.
- The effective marginal cost of delivering an exported unit is higher than for a unit of domestic sales, because of transport costs, but this is consistent with the higher marginal revenue.
- Thus perceived marginal revenue can equal marginal cost in both markets at positive output levels. This is true for firms in both countries which gives rise to two-way trade.
- Moreover each firm has a smaller markup over cost in its export market than at home: the f.o.b. price for exports is below domestic price: reciprocal dumping.

► Comparative statics:

- If $\tau \uparrow$: s ? With $\tau = 1$?
- Prices?

The Brander-Krugman (1983) model (7)



R Code:

```
s<-c(0:100)/100
c<-2; sigma<-5; tau<-0.95
p<-c*sigma/(sigma-s)
pstar<-(c/tau)*(sigma/(sigma-(1-s)))
plot(s,pstar,ylim=c(1.8,2.7), xlab="market shares", ylab="prices"); points(s,p)
tau<-0.93
pstar1<-(c/tau)*(sigma/(sigma-(1-s))); points(s,pstar1,col=2)
```

Oligopoly models: summing-up

- ▶ Strategic thinking by firms is good for consumers, but not always if trade is costly.
- ▶ Market shares depend on c : Strategic trade policy
- ▶ More gains from trade:
 - ▶ Increasing returns: scale effect (Adam Smith) magnify the pro-competitive effect ($p \downarrow$ and $X \uparrow$)
 - ▶ Some firms exit: defragmentation effect (Helpman, 1984). But how the selection works?
 - ▶ More varieties: this effect is better analyzed using differentiated products in monopolistic competition.

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