Lecture 7b:

Monopolistic competition

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C181 – International Trade
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2- Monopolistic Competition

“Monopolistic competition”

• Firms don’t take their price as given
  → Firms account for how their production affects prices

• But take the price of their competitors as given
  → Greatly simplifies equilibrium
  → “Brands” in an almost a competitive environment
2- Monopolistic Competition

Assumptions of the model of monopolistic competition:

Assumption 1: Firms produce using a technology with increasing returns to scale.

- There is a constant marginal cost $MC = c$
- There is a fixed cost $F > 0$
Assumptions of the model of monopolistic competition:

**Assumption 2:** Firms produce differentiated goods

- Each firm faces a downward-sloping demand curve for its product and has some control of its price.

**Assumption 3:** There are “many” firms in the industry.

- Firms take the average price across firms as given.
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Assumptions of the model of monopolistic competition:

**Demand:**

\[
Q = S \cdot \left[ 1/n - b (P - \bar{P}) \right]
\]

- S: total industry output (assumed fixed)
- n: number of firms
- Q: quantity produced by each firm
- b: sensitivity of demand to prices
Assumption 4: Because firms can enter and exit the industry freely, *profits are zero in the long run*.

- Firms will enter as long as it is possible to make monopoly profits, and the more firms that enter, the lower profits per firm become.

- Profits for each firm end up as zero in the long run.
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- Profits for each firm end up as zero in the long run.

- We will also examine what happens in the “short run”, i.e. without adjusting the number of firms.
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Equilibrium

We will describe the equilibrium with two key variables: price $P$ and number of firms “$n$”
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We will use two curves in the $(P,n)$ space:

• “CC” curve: average cost as a function of “$n$”
• “PP” curve: average price as a function of “$n$”
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Equilibrium

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We will use two curves in the \( (P,n) \) space:

- “CC” curve: average cost as a function of “\( n \)”
- “PP” curve: average price as a function of “\( n \)”

Equilibrium with zero profits:

\[ P = AC \rightarrow \text{Intersection between CC and PP} \]
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Equilibrium

Symmetric equilibrium:

Since all firms have the same costs and demand, all firms have the same P, Q, AC, etc.

Easy to retrieve quantities once we know “n”:

\[ Q = \frac{S}{n} \]
“CC” curve: Average cost

Combining:

• \( AC = c + \frac{F}{Q} \)
• \( Q = \frac{S}{n} \),

\( \rightarrow \) We obtain the CC curve: \( AC = c + n \frac{F}{S} \)

**Intuition:** costs are high when there are too many firms (each firm produces in small quantities)
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“PP” curve: MR = c

- Demand system: \( Q = S \cdot \left[ \frac{1}{n} - b \left( P - \bar{P} \right) \right] \)
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“PP” curve: MR = c

- Demand system:
  \[ Q = S \left[ \frac{1}{n} - b \left( P - \bar{P} \right) \right] \]

  yields the following MR:
  \[ MR = P - \frac{Q}{b S} \]
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“PP” curve: $\text{MR} = c$

- Demand system: $Q = S \cdot [1/n - b(P - \bar{P})]$
yields the following MR: $\text{MR} = P - \frac{Q}{bS}$

- Equilibrium imposes: $c = \text{MR} = P - \frac{Q}{bS}$

But then how to get a relationship between $P$ and “n”?
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“PP” curve: $MR = c$

- Demand system: $Q = S \cdot \left[1/n - b \left(P - \bar{P}\right) \right]$ yields the following $MR$: $MR = P - \frac{Q}{bS}$

- Equilibrium imposes: $c = MR = P - \frac{Q}{bS}$

$\Rightarrow$ With $Q = S/n$, we obtain the PP curve: $P = c + \frac{1}{bn}$

**Intuition:** Markups ($P - c$) are lower and prices are closer to MC (perfect competition) with many firms
Equilibrium: $P = AC$ reached for $(n_2, P_2)$
What if we deviate from equilibrium \( P_2, n_2 \)?

**Starting from** \( n_1 < n_2 \):

- PP curve above the AC curve
- \( P > AC \) implies that there are positive profits: Costs are low (large quantities) and markup are large

→ New firms enter and “n” increases
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What if we deviate from equilibrium $P_2, n_2$?

Starting from $n_3 > n_2$:

- PP curve **below** the AC curve
- $P < AC$ implies that there are **negative** profits:
  Costs are high (**small scale**), markup are low (**competition**)

→ Firms exit and “n” decreases
Equilibrium: $P = AC$
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Optimal costs and number of Firms (brands)

- Why aren’t there more firms?

- Why aren’t there fewer firms?
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Optimal costs and number of Firms (brands)

- Why aren’t there more firms?
  If there are too many firms, production scale is too small, markups are too small → negative profits

- Why aren’t there fewer firms?
  If there are too few firms, profits are positive
  → New firms enter
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Quantitative analysis:

\[
\begin{align*}
\text{PP curve: } P &= c + \frac{1}{b n} \\
\text{CC curve: } P &= AC = c + n \frac{F}{S}
\end{align*}
\]
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Quantitative analysis:

\[
\begin{align*}
\text{PP curve: } & \quad P = c + \frac{1}{b \, n} \\
\text{CC curve: } & \quad P = AC = c + n \frac{F}{S}
\end{align*}
\]

Implies:

\[
c + \frac{1}{b \, n} = c + n \frac{F}{S} \implies n = \sqrt{\frac{S}{b \, F}}
\]
Quantitative analysis:

\[ PP \text{ curve: } P = c + \frac{1}{b \ n} \]
\[ CC \text{ curve: } P = AC = c + n \frac{F}{S} \]

Implies: \[ c + \frac{1}{b \ n} = c + n \frac{F}{S} \Rightarrow n = \sqrt{\frac{S}{b \ F}} \]

**Example:**
Doubling fixed costs \( \Rightarrow \) Divide \( n \) by \( \sqrt{2} = 1.414 \)
Doubling market size \( \Rightarrow \) Multiply \( n \) by \( \sqrt{2} = 1.414 \)
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Quantitative analysis:

\begin{align*}
\text{PP curve:} & \quad P &= c + \frac{1}{b n} \\
\text{Nb. firms:} & \quad n &= \sqrt{\frac{S}{b F}} \\
\text{Implies following markup:} & \quad P - c &= \sqrt{\frac{F}{b S}}
\end{align*}
Quantitative analysis:

\[
\begin{align*}
\text{PP curve: } P &= c + \frac{1}{b \ n} \\
\text{Nb. firms: } n &= \sqrt{\frac{S}{b \ F}}
\end{align*}
\]

Implies following markup: 
\[
P - c = \sqrt{\frac{F}{b \ S}}
\]

**Example:**
Doubling fixed costs ⇒ Multiply markups by \(\sqrt{2} = 1.414\)
Doubling market size ⇒ Divide markups by \(\sqrt{2} = 1.414\)
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Trade

Next step:

What is the effect of trade on:
- production?
- Number of firms?
- prices?
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Summary of assumptions:

Assumption 1: \( TC = c.Q + F \)

Assumption 2: Firms produce differentiated goods

Assumption 3: There are many firms in the industry

Assumption 4: Because firms can enter and exit the industry freely, profits are zero in the long run.
Free trade (for now): no transport cost

Both markets have the same technology and the same demand
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Trade

Free trade (for now): no transport cost

Both markets have the same technology and the same demand

One market has a size $S$
The other market has a size $S^*$

$\rightarrow$ New market with total size $S + S^*$
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Preview of results from the model

Clicker question:

1- When a country opens to trade, does the number of brands available to consumers increase?

a) Yes

b) No
Clicker question

2- When a country opens to trade, does production in each firm increase?

a) Yes

b) No
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Clicker question

3- When a country opens to trade, does the number of firms in each country increase?

a) Yes
b) No
Clicker question

4- When a country opens to trade, do prices increase?

a) Yes

b) No
How does an increased market size affect the equilibrium?

1) **Average cost** “CC” curve combines:
   - \( AC = c + F/Q \)
   - and: \( Q = (S + S^*)/N \),
   \[ \Rightarrow \text{New CC curve: } AC = c + N F/(S + S^*) \]
   \[ \Rightarrow \text{CC curve shifts downward} \]
How does an increased market size affect the equilibrium?

2) Price “PP” curve combines:

- Equilibrium imposes: \( c = MR = P - \frac{Q}{b \left( S + S^* \right)} \)
- and: \( Q = \frac{(S + S^*)}{N} \),

\[ P = c + \frac{1}{b \cdot N} \]

\( \rightarrow \) PP curve doesn’t change
Effect of a market size increase:

Cost, $C$ and Price, $P$

$C_1$ and $C_2$

$P_1$ and $P_2$

Number of firms, $n$
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Effect of Trade

Gains for consumers?
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Effect of Trade

Gains for consumers?

TWO sources of gains for consumers:

• Lower prices
• More brands to choose from
Hypothetical example: Auto industry

(a) Home

(b) Foreign
Hypothetical example: Auto industry

Price per auto, in thousands of dollars

Number of firms, n

(c) Integrated
Hypothetical example: Auto industry

<table>
<thead>
<tr>
<th></th>
<th>Home Market, Before Trade</th>
<th>Foreign Market, Before Trade</th>
<th>Integrated Market, After Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry output (# of autos)</td>
<td>900,000</td>
<td>1,600,000</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Number of firms</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Output per firm (# of autos)</td>
<td>150,000</td>
<td>200,000</td>
<td>250,000</td>
</tr>
<tr>
<td>Average cost</td>
<td>$10,000</td>
<td>$8,750</td>
<td>$8,000</td>
</tr>
<tr>
<td>Price</td>
<td>$10,000</td>
<td>$8,750</td>
<td>$8,000</td>
</tr>
</tbody>
</table>
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Effect of Trade

Gains for firms?
3- Trade under monopolistic competition

Effect of Trade

Gains for firms?

- Zero profits before trade liberalization
- Zero profits after trade liberalization
→ No change
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Effect of Trade

Another important/subtle question:

Starting from two isolated markets, are there more firms before or after trade liberalization?
Clicker question

Suppose that we start from two separate markets (Home & Foreign) with \( n \) firms at Home and \( n^* \) firms in Foreign. Also assume that \( n > n^* \). Now, with trade integration, the total number of firms \( N \) is such that:

a) \( n + n^* < N \)

b) \( n < N < n+n^* \)

c) \( n^* < N < n \)

d) \( N < n^* \)
Clicker question

Suppose that we start from two separate markets (Home & Foreign) with \( n \) firms at Home and \( n^* \) firms in Foreign. Also assume that \( n > n^* \). Now, with trade integration, the total number of firms \( N \) is such that:

Answer:
Starting from two isolated markets, are there more firms before or after trade liberalization?

→ With trade, the combined market has more firms than each individual market

→ But there are fewer firms with trade than initially if we take the sum of the two markets
Starting from two isolated markets, are there more firms before or after trade liberalization?

→ With trade, the combined market has more firms than each individual market

→ But there are fewer firms with trade than initially if we take the sum of the two markets

→ Trade induces an exit of firms in each market
Effect of Trade

Initially:
Home has \( n \) firms with: \( n = \sqrt{\frac{S}{b \cdot F}} \)

Foreign has \( n^* \) firms with: \( n^* = \sqrt{\frac{S^*}{b \cdot F}} \)

With trade, the total number of firms is:

\[
N = \sqrt{\frac{S + S^*}{b \cdot F}} < n + n^*
\]
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Effect of Trade

Intuition:

- There are more brands available to each consumer, and therefore more competition.
- To compensate, each firm has to produce in larger quantities in order to reduce average costs.

→ If each firm produces more than in Autarky, the combined number of firms has to decrease!

\[(N < n + n^*)\]
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Numerical example:

If we merge two identical markets:

- **Total number of firms?**
If we merge two identical markets:

• **Total number of firms** multiplied by $\sqrt{2} = 1.414$
  
  $\rightarrow$ Number of firms is multiplied by LESS than 2
  $\rightarrow$ Survival rate: $1.41 / 2 = 71\%$ in each market

• Consumer brands? Quantities?
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Numerical example:

If we merge two identical markets:

• **Total number of firms** multiplied by $\sqrt{2} = 1.414$
  → Number of firms is multiplied by LESS than 2
  → Survival rate: $1.41 / 2 = 71\%$ in each market

• Consumers have access to 41% **more brands**

• **Quantities** produced by each firm also increase by 41% (they are multiplied by $\sqrt{2} = 1.414$)
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“Short-run” vs. “long-run” effects:

In the long-run: the number of firms adjusts so that firms have zero profits, with or without trade.

Questions:
• What if the number of firms does not adjust?
• Would there be positive or negative profits?
Clicker question:
When a country opens to trade:

a) In the short run, firms make positive profits and therefore the number of firms tends to increase, and firms become smaller

b) In the short run, firms make positive profits and therefore the number of firms tends to decrease, and firms become bigger

c) In the short run, firms make negative profits and therefore the number of firms tends to decrease, and firms become bigger

d) In the short run, firms make negative profits and therefore the number of firms tends to increase, and firms become smaller
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When a country opens to trade:
3- Trade under monopolistic competition

Effect of Trade

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\( N < n + n^* \)
3- Trade under monopolistic competition

Effect of Trade

Summary of long-term effects of Trade:

→ Lower prices, lower markups
→ More brands available to consumers
→ Each firm produces more
→ But total number of firms decreases