This lecture will introduce:

- Profit maximization
- Price Taking Firm
  - Supply curve
  - Application: multi-plant firm
- Price Setting Firm
  - Price-cost margin
  - Price discrimination
- Competitive Market
  - Efficiency of Competitive Market

Short Run Cost Curves

Marginal Analysis

- Firm’s objective
  - to maximize profit $\pi = TR - TC$
- If $MR > MC$, the extra revenue from selling one more unit exceeds the extra cost.
- If $MR < MC$, the extra revenue from selling one more unit is less than the extra cost.
- If $MR = MC$, economic profit is maximized.
Profit Maximization

- $\pi$ is maximized if
  - $MR = MC$ and $MR$ cuts $MC$ from above
  - So long as it is worthwhile producing
- This holds for whatever market structure such as
  - Perfect competition (price taking firm)
  - Monopoly (price setting firm)

**Price Taking Firm**

<table>
<thead>
<tr>
<th>Quantity (sweaters per day)</th>
<th>0</th>
<th>4</th>
<th>9</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic loss</td>
<td>100</td>
<td>183</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>Economic profit = $TR - TC$</td>
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**Profit-Maximizing Output for a Price Taking Firm**

- $D = AR = MR$

**Total Revenue, Total Cost, and Economic Profit for a Price Setting Firm**
A Price Setting Firm’s Profit Maximizing Output

\[ MR(Q) = P(Q) + Q \frac{dP(Q)}{dQ} \]

Price Taking Firm

A Firm’s Supply Curve

MC curve = Supply curve

A Firm’s Supply Curve
Application: Multi-plant firm

- Suppose a perfectly competitive firm has two plants producing identical goods with marginal cost functions $MC_1(Q_1)$ and $MC_2(Q_2)$.
- It is straightforward to show that it show produce $Q_1$ and $Q_2$ in the two plant so that $MC_1(Q_1) = MC_2(Q_2) = P$ where $P$ is market price.

Price Setting Firm and How Monopoly Arises

- The simplest form of price setting firm is monopoly
- A **monopoly** is an industry that produces a good or service
  - for which no close substitute exists and
  - in which there is one supplier that is protected from competition by a **barrier** preventing the entry of new firms.
Monopoly Price-Setting Strategies

- Price discrimination is the practice of selling different units of a good or service for different prices.
- A single-price monopoly is a firm that must sell each unit of its output for the same price.

Single-Price Monopoly

- The firm’s demand curve is the market demand curve.
- Marginal revenue is not the same as the market price.
- There is no supply curve for a monopoly.

A Monopoly’s Output and Price

Price and cost (dollars per hour)

<table>
<thead>
<tr>
<th>Quantity (haircuts per hour)</th>
<th>$0</th>
<th>$1</th>
<th>$2</th>
<th>$3</th>
<th>$4</th>
<th>$5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MR</td>
<td></td>
<td></td>
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</table>

An example: Linear Demand $Q = 100 − 2P$; $AC=MC=10$

- Inverse demand: $P = 50 − Q/2$
- $TR = P \cdot Q = (50 − Q/2) \cdot Q = 50Q − Q^2/2$
- $MR = 50 − Q$
  - Remark: if $P = A − BQ$, then $MR = A − 2BQ$
- $MR = MC \rightarrow 50 − Q = 10 \rightarrow Q = 40$
- Substituting $Q = 40$ into inverse demand, $P = 50 − 40/2 = 30$
Optimal output, profit margin, and profit

\[ MC = AC \]
\[ AR = P(Q) = 50 - Q/2 \]

Profit = profit margin \( \times Q^* \)
\[ = (P^* - AC) \times Q^* \]

\[ MR = 50 - Q \]

Price-cost Margin and Elasticity

\[ MR = \frac{dTR}{dQ} = P(Q) + Q \frac{dP(Q)}{dQ} \]
\[ = P \left( 1 + \frac{Q \frac{dP(Q)}{dQ}}{P} \right) \]
\[ = P \left( 1 + \frac{dP(Q)}{dQ} \right) \frac{1}{P} \]
\[ = P \left( 1 + \frac{1}{|e_{P,Q}|} \right) \]
\[ = P \left( 1 - \frac{1}{|e_{P,Q}|} \right) \]

Price-cost market and

- Equating \( MC \) with \( MR \), we have

\[ MC = MR = P \left( 1 - \frac{1}{|e_{P,Q}|} \right) \]

price - cost margin
\[ = \frac{P - MC}{P} = \frac{1}{|e_{P,Q}|} \]

- The more elastic the demand, the smaller the price-cost margin
- Price-cost margin, a.k.a. price-cost markup, or Lerner Index of market power (1934).

Competition and Efficiency

- Efficiency is achieved when all the gains from trade have been realized (social welfare is maximized).
Monopoly and Competition Compared

Price Discrimination

- Arcadia Publisher is planning to publish a book.
  - loyalty to the author is fixed at $2M
  - production cost=$0 per copy
  - two groups of buyers
    - 100K group 1 readers—each willing to pay up to $30
    - 400K group 2 readers—each willing to pay up to $5
- If p= $30, only group 1 readers will buy the book. Arcadia obtains $30x100K =$3M (gross of loyalty)
- If p= $5, both groups of readers will buy the book. Arcadia obtains $5x500K=$2.5M (gross of loyalty)
- Hence, charging $30 is better.

Inefficiency of Monopoly

Price Discrimination

- Now suppose Arcadia knows that all group 1 readers are in HK and group 2 readers are in Chile. Then it can charges a fee of $30 for a book sold in HK and $5 for a book sold in Chile.
- Price discrimination leads to
  - greater profits
  - greater social welfare!!
Determination of differentiated prices under constant marginal cost

More generally, the problem is

\[
\max_{Q_1, Q_2} \left( P_1(Q_1)Q_1 + P_2(Q_2)Q_2 \right) - TC(Q_1 + Q_2)
\]

- Optimal output for the two markets are given by
  \[
  P_1 + Q_1 \frac{\partial P_1(Q_1)}{\partial Q_1} - \frac{\partial TC}{\partial Q_1} = 0
  \]
  \[
  P_2 + Q_2 \frac{\partial P_2(Q_2)}{\partial Q_2} - \frac{\partial TC}{\partial Q_2} = 0
  \]
  \[
  MC_1 = P_1 + Q_1 \frac{\partial P_1(Q_1)}{\partial Q_1} = P_2 + Q_2 \frac{\partial P_2(Q_2)}{\partial Q_2} = MC_2
  \]

- Equalization of marginal cost and marginal revenue in each segment

Market Equilibrium

- \textit{Equilibrium} is defined as the price at which the quantity demanded equals the quantity supplied (so markets clear)
  - While all five conditions for perfect competition are (obviously) never fully satisfied, the model is still useful as frame of reference.
- When a market is out of equilibrium, market forces push the price towards equilibrium
  - \textit{Excess supply} (a.k.a., surplus) -- This triggers a price decrease
  - \textit{Excess demand} (a.k.a., shortage) -- This triggers a price increase
Market Equilibrium (cont.)

Long run competitive equilibrium

- Firms enter and exit so achieve long run competitive equilibrium:
  - Each firm produces at its minimum long run average cost
  - Each firm earns a zero profit
  - The number of firms is determined by supply and demand

Invisible Hand

- Social welfare (SW) = net gains from production and trade
- In the absence of tax, SW = buyer surplus + seller surplus
- In the presence of tax, SW = buyer surplus + seller surplus + tax revenue
- An outcome is efficient if the SW cannot be further increased. [taxation cannot increase SW, to be shown shortly]
- Perfect competition is efficient, in which
  - marginal benefit = price
  - marginal cost = price
  - single price in market

Minimum Wage: Equilibrium

- Net inc. in seller surplus = f'dg - e'ghb
- Net inc. in buyer surplus = -(f'dg + e'gb)
- Net inc. in SW = -(ghb + e'gb)
Minimum Wage: Losses

- deadweight losses -- sellers willing to provide item at price that buyers willing to pay, but provision doesn’t occur
- price elasticities of demand and supply

Can tax improve SW?

Net inc. in buyer surplus = -(fdge + egb)
Net inc. in seller surplus = -(djhg + ghb)
Net inc. in tax revenue = fdge + djhg
Net inc. in SW = -(egh + ghb)