Monopoly
Chapter 24
Motivating Questions

- What price and quantity does a monopoly choose?
- What are the welfare effects of monopoly?
- What are the effects of taxes on monopolies?
- Is monopoly every justified/efficient?
A monopoly is a sole supplier of a good.

The monopolist’s demand curve is the market demand curve.

*Price maker* not a price taker

Can set price (quantity is constrained by demand curve relationship)

Or: chooses quantity, which determines price
What causes monopolies?

- Legal fiat: US Postal Service
- Patent: drugs, technology; intellectual property
- Sole ownership of a resource: toll road
- Cartel: OPEC
- Large economies of scale: local utilities
Monopoly is heavily regulated

- Antitrust Law: abuse of monopoly power is a felony
- Dept. of Justice (DOJ) has antitrust division
- Federal Trade Commission (FTC) has regulatory oversight

But govt. creates monopolies (USPS) and issues patents/copyrights that grant monopoly power.

If monopoly is so bad, why does the government enable it in some cases?
What quantity maximizes profits?

Setup the problem:

- For any firm, profit is given by

\[ \Pi(y) = R(y) - C(y), \]

where \( R(y) \) is revenue and \( C(y) \) is cost.

- Profit maximization problem:

\[ \max_{y} R(y) - C(y) \]
What quantity maximizes profits?

Graphical analysis:

$R(y) = p(y)y$
What quantity maximizes profits?

Graphical analysis:

$$R(y) = p(y)y$$

The profit function $R(y)$, as a function of quantity $y$, is represented graphically with a parabolic curve. The linear function $p(y)y$ indicates the revenue at each quantity level, while $c(y)$ represents the cost function. The point where the revenue function peaks indicates the quantity that maximizes profits.
What quantity maximizes profits?

Graphical analysis:

\[ R(y) = p(y)y \]

Where:
- \( R(y) \) is revenue
- \( p(y) \) is price
- \( y \) is quantity

\[ c(y) \]

\[ \Pi(y) \]
What quantity maximizes profits?

Graphical analysis:

\[ R(y) = p(y)y \]

\[ c(y) \]

\[ \Pi(y) \]

\[ y^* \]
What quantity maximizes profits?

Graphical analysis:

\[ R(y) = p(y)y \]

\[ c(y) \]

\[ \Pi(y) \]

\[ y^* \]
What quantity maximizes profits?

Graphical analysis:

At the profit-maximizing output level, the slopes of the revenue and cost curves are equal: $MR(y^*) = MC(y^*)$. 

$$R(y) = p(y)y$$

$$c(y)$$

$$\Pi(y)$$
What quantity maximizes profits?

Algebraic analysis:

- **Optimality condition:**

  \[
  \frac{d\Pi(y)}{dy} = 0 \iff R'(y) - C'(y) = 0 \iff R'(y) = C'(y)
  \]

- At the profit maximizing quantity, \( y^* \):

  \[
  MR(y) = MC(y)
  \]
What quantity maximizes profits?

Algebraic analysis:

- **If the market is competitive**, the firm takes $p$ as given/fixed (demand curve is flat)
- In that case, $R(y) = py$, where $p$ is constant, so $MR(y) = p$.
- Profit-maximizing condition: $p = MC$

\[ D = MR = p \]
What quantity maximizes profits?

Algebraic analysis:

- Monopoly is not a price taker, though
- Demand slopes down
- Recall $MR(y) = P(y) + P^*(y)y$ is below $P(y)$
What quantity maximizes profits?

Algebraic analysis:
- Choose quantity \( y^* \) s.t. \( MR = MC \)
- Set price according to \( P(y^*) \)
- Profit-maximizing condition: \( p = MC \)
- Price is marked-up over marginal cost \( p > MC \)
Monopoly: Example

- Inverse Demand: $P(y) = 10 - y$, so marginal revenue is...

- **Clicker Vote:**
  
  A) $MR = -1$
  
  B) $MR = 10 - \frac{y}{2}$
  
  C) $MR = 10 - y$
  
  D) $MR = 10 - 2y$
Monopoly: Example

- Inverse Demand: \( P(y) = 10 - y \), so marginal revenue is \( MR(y) = 10 - 2y \).
- Cost function: \( C(y) = 2y + y^2 \), so \( MC(y) = 2 + 2y \)

Optimality condition:

\[
MR = MC \implies 10 - 2y = 2 + 2y
\]

So \( y^m = \frac{8}{4} = 2 \)

... and \( p^m = P(y^m) = 10 - 2 = 8 \)
Monopoly: Example

\[ p^m = 8 \]

\[ y^m = 2 \]

MC = MR

Demand

price

y

MC
Monopoly Price and Elasticity of Demand

How does the monopoly price relate to the elasticity of demand?

\[ MR = p(y) + y \frac{dp(y)}{dy} = p(y)\left[1 + \frac{y}{p(y)} \frac{dp(y)}{dy}\right] \]

Recall that \( \epsilon = \frac{p(y)}{y} \frac{dy}{dp(y)} \).

So

\[ MR = p(y)\left[1 + \frac{1}{\epsilon}\right]. \]
Monopoly Price and Elasticity of Demand

How does the monopoly price relate to the elasticity of demand?

- $MR = p(y)[1 + \frac{1}{\epsilon}]$ and $MR = MC$, so $MC = p(y)[1 + \frac{1}{\epsilon}]$.
- Rewrite as
  
  $$p(y) = \frac{MC}{1 + \frac{1}{\epsilon}}$$

- Note that $MR, p > 0$ implies $\epsilon < -1$
- This means that a monopolist chooses an output level at which demand is elastic.
- Intuition: if on inelastic part, cutting output (raising price) increases revenue (and maybe lowers costs)
Monopoly Price and Elasticity of Demand

How does the monopoly price relate to the elasticity of demand?

\[ p(y) = \frac{MC}{1 + \frac{1}{\epsilon}} \]

- Because elasticity is negative (demand slopes down), price is always above \( MC \)
- Markup pricing: price is marginal cost plus a “markup”. What happens to the markup as demand becomes less elastic?
- Monopolist increases price
- Example: if \( \epsilon = -3 \), \( p(y) = \frac{3MC}{2} \); if \( \epsilon = -2 \), \( p(y) = 2MC \)
Perfect Competition vs. Monopoly

Price and Quantity: given a cost function, how does the behavior of a monopolist compare to that of a competitive firm?

$\text{MC}$

$\text{Demand}$

$\text{MR}$

$p^m > p^c$ and $y^m < y^c$
Inefficiency of Monopoly

- What are the welfare effects of monopoly? Who gains and who loses?

- Since $p^m > p^c$, seller gains, consumers lose

- But since $y^m < y^c$, we know that there are unrealized gains from trade. So the losses outweigh the gains: there is some welfare loss.

- The deadweight loss (DWL) is the societal loss in welfare. It measure the inefficiency of monopoly relative to the competitive outcome.
Calculating the DWL of Monopoly

In competitive equilibrium
Consumer surplus = $A + B + C$

Price vs. Quantity Graph:
- Demand curve
- Marginal Revenue (MR)
- Marginal Cost (MC)
- Competitive equilibrium point at $y^c$ with price $p^c$
- Monopoly equilibrium point at $y^m$ with price $p^m$

The area $A + B + C$ represents the consumer surplus in competitive equilibrium.
Calculating the DWL of Monopoly

In competitive equilibrium:
Producer surplus = D + E
Calculating the DWL of Monopoly

In competitive equilibrium
Total surplus = A + B + C + D + E

Monopoly
Quantity & Price
Welfare
Calculating the Deadweight Loss of Monopoly

In Monopoly case
Producer surplus = B + D
Calculating the DWL of Monopoly

In Monopoly case
Consumer surplus = A
Calculating the Deadweight Loss of Monopoly

In Monopoly case
Total surplus = A + B + D

DWL = (A + B + C + D + E) – (A + B + D) = C + E

Demand
MR
price

MC
MC(y_m)

p_m
p_c

y_m
y_c

y
Inefficiency of Monopoly

The need for regulation

- Competitive market provides greater surplus than monopoly
- Can changing from a monopolistic market to a competitive one make *everyone* (consumers and monopolist) better off (Pareto improving)?
- In other words, is there room for a Pareto improving deal in which a monopolist agrees to act like a competitive firm?
- No, because this will make the firm worse off
- Thus, the DWL of monopoly rationalizes antitrust laws
Example (continued)

- Inverse demand: $P(y) = 10 - y$
- Marginal cost: $MC(y) = 2 + 2y$
- Recall: $p^m = 8$ and $y^m = 2$
- What is the competitive equilibrium?
- Use $p = MC$

$$P(y^c) = 10 - y^c = 2 + 2y = MC(y^c)$$

- So $y^c = \frac{8}{3}$ and $p^c = \frac{22}{3}$
So what is the DWL of monopoly?

We can calculate DWL using

\[
DWL = \frac{1}{2} [P(y^m) - MC(y^m)][y^c - y^m]
\]

Aside: in general, this is an approximation. Because of linear demand, MC, here it is exact.

So DWL is

\[
DWL = \frac{1}{2} [8 - 6][\frac{8}{3} - 2] = \frac{2}{3}
\]