Market Power

Lecture 6

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Monopoly

Monopoly and Market Power

- **Monopoly**: single seller of a good with no close substitutes
- **Market power**: ability to set price above marginal cost
- Monopolists face a downward-sloping demand curve (knows it can influence the market price)
- Monopoly leads to higher prices, lower output, and deadweight loss compared to perfect competition

Perfectly Competitive Firm vs. Monopolist

A **perfectly competitive firm**'s problem:

$$\max_q \; P \cdot q - C(q)$$

First-order condition:

$$P = MC(q)$$

A **monopolist**'s problem:

$$\max_Q \; P(Q) \cdot Q - C(Q)$$

First-order condition:

$$\underbrace{P(Q) + Q \cdot P'(Q)}_{MR(Q)} = MC(Q)$$

Why are price and marginal revenue different for a monopolist?

Monopoly Equilibrium

Monopolist maximizes:

$$\max_{Q} \ \pi(Q) = P(Q) \cdot Q - C(Q)$$

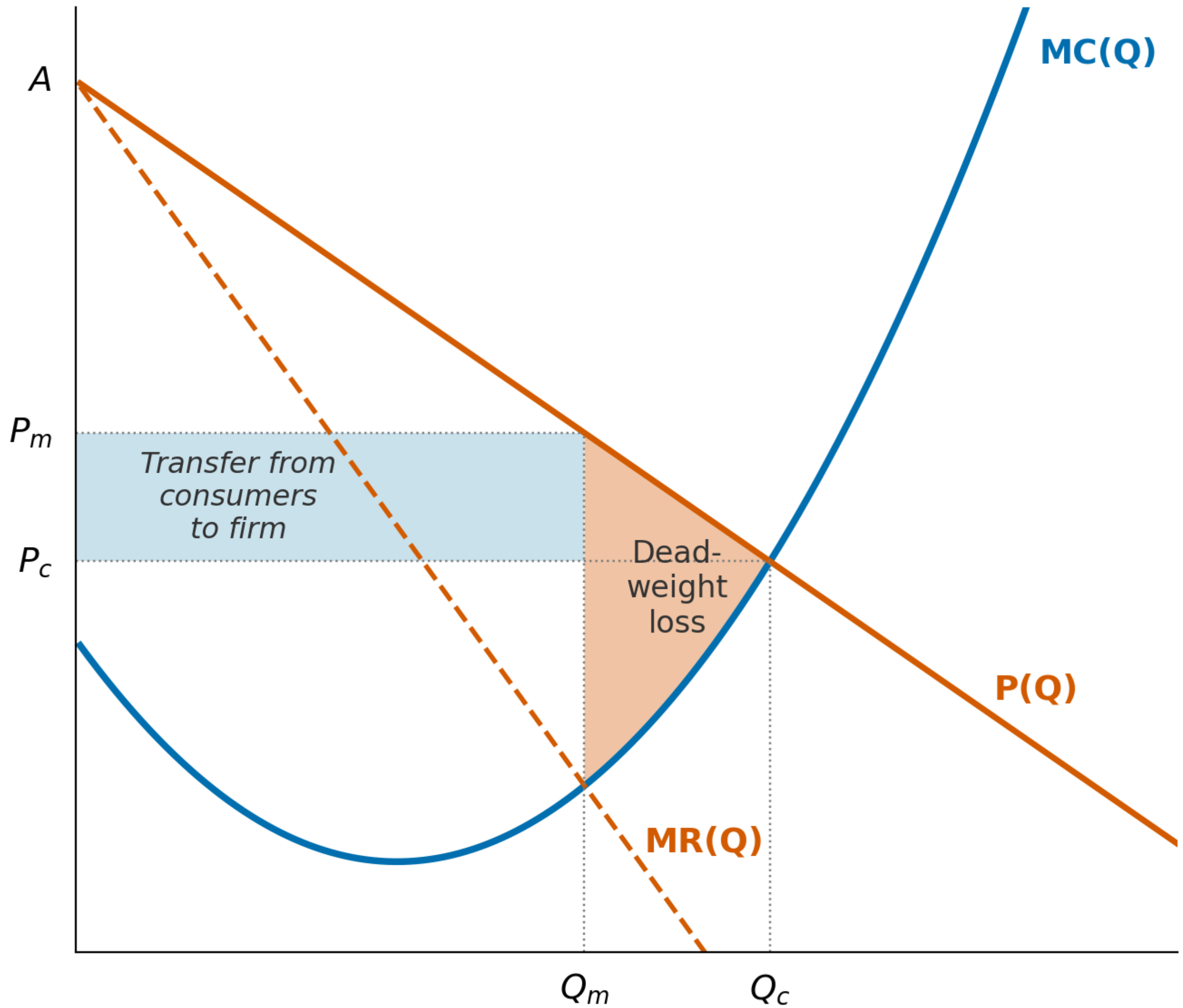
First-order condition:

$$\frac{d\pi}{dQ} = MR(Q) - MC(Q) = 0$$

Where marginal revenue is:

$$MR(Q) = \underbrace{P(Q)}_{\text{output effect}} + \underbrace{Q \cdot P'(Q)}_{\text{price effect}}$$

Monopoly Equilibrium on a Graph



The Inverse Elasticity Rule

From $MR = P + Q \cdot P'(Q)$, we can express marginal revenue in terms of the price elasticity of demand ε_D:

$$MR = P\left(1 + \frac{1}{\varepsilon_D}\right) = P\left(1 - \frac{1}{|\varepsilon_D|}\right)$$

Setting $MR = MC$:

$$\boxed{\frac{P - MC}{P} = \frac{1}{|\varepsilon_D|}}$$

The **Lerner Index** (markup over price) equals the inverse of the absolute elasticity. More inelastic demand → larger markup.

Question: Monopoly Pricing and Elasticity

If demand curve takes constant elasticity form $Q = aP^{-\varepsilon}$ and marginal cost is constant at c, what price will the monopolist charge?

- Write the profit-maximization problem and derive the first-order condition.
- Solve for the optimal price P^* in terms of c and ε.

Monopolies Around You

- Can you think of any real-world examples of monopolies or firms with significant market power? What do you think prevents other firms from entering these markets?

- Do you think these monopolistic firms charge prices above marginal cost?

Sources of Monopoly Power

Price Discrimination

Price Discrimination

- A monopoly may be able to increase profits by departing from a single-price policy for its output
- Charging different prices to different consumers for the same good is called **price discrimination**
- When is price discrimination feasible? Can it be profitable? What are the welfare implications?
- Three degrees of price discrimination: first-degree (perfect), second-degree (screening), third-degree (segmentation)

First-Degree (Perfect)

- Charge each consumer their maximum willingness to pay for each unit.
- Output = competitive level, no deadweight loss, but all surplus goes to the firm.
- Requires perfect information, which is rare in practice. Examples?

Second-Degree (Screening)

- Offer a menu of options and let consumers self-select. Price varies by quantity or version.
- Mechanisms:
  - Block pricing: different per-unit price by quantity tier (electricity bills, bulk discounts)
  - Bundling: sell products as a package (Microsoft Office, cable TV, meal deals)
  - Versioning: same product at degraded vs. premium tiers (Spotify Free/Premium, economy/business class)
  - Two-part tariffs: fixed fee + per-unit price (Costco membership, gym + class fees)

Third-Degree (Segmentation)

- Charge different prices to identifiable groups with different elasticities.
- Rule: higher markup in less elastic market.

$$P_i/P_j = \frac{1 - 1/|\varepsilon_i|}{1 - 1/|\varepsilon_j|}$$

- Examples: student discounts, geographic pricing, peak/off-peak, pharmaceutical pricing by country.

Do we think this is generally welfare-improving?

Imperfect Competition

The Space Between

Most markets are neither perfect competition nor monopoly.

- A few large airlines dominate routes
- Coca-Cola and Pepsi in soft drinks
- Samsung and Apple in smartphones
- OPEC countries in oil production

Oligopoly: A market with a small number of firms whose decisions are **interdependent** i.e. each firm's optimal choice depends on what the others do.

How do firms compete in oligopoly? How do they react to each other's actions? **Do they set prices or quantities?**

Nash Equilibrium

- Before we move on, we will define one concept from **game theory** that will be useful for analyzing oligopoly: **Nash equilibrium**.
- **Game theory** studies strategic interactions between rational decision-makers and hence is a natural tool for analyzing oligopoly where firms' decisions are interdependent.
- A **Nash equilibrium** is a set of strategies (one for each player) such that no player can improve their payoff by unilaterally changing their strategy, given the strategies of the others.

Price Competition

Bertrand Model

Setup:

- Two firms produce a **homogeneous** (identical) good
- Each firm simultaneously chooses a **price**
- Consumers buy from the firm with the lowest price (if equal, split the market)
- Both firms have constant marginal cost c

Key question: What prices will the firms choose?

Bertrand: Reasoning

Suppose firm 1 sets $p_1 > c$.

- Firm 2 can capture the **entire market** by setting $p_2 = p_1 - \epsilon$
- But then firm 1 would want to undercut firm 2…
- This undercutting continues until…

Nash equilibrium: $p_1^* = p_2^* = c$

Both firms price at marginal cost reaching the **competitive outcome** (with just two firms!)

This is the **Bertrand paradox**: two firms are enough to eliminate all market power.

Bertrand: Verifying the Equilibrium

Why is $p_1^* = p_2^* = c$ a Nash equilibrium?

Can either firm profit by deviating?

- **Raise price?** You lose all customers (rival still charges c). Profit stays at 0.
- **Lower price?** You get the whole market, but sell below cost. Profit is *negative*.

No profitable deviation exists. ✓

Why can't $p_1 = p_2 > c$ be an equilibrium?

Either firm could undercut by ϵ and capture the entire market, roughly doubling its profit.

What Resolves the Bertrand Paradox?

Real oligopolies earn positive profits. The Bertrand model misses something. Key extensions:

- **Capacity constraints**: firms can't always serve the whole market
- **Product differentiation**: goods aren't identical, so undercutting doesn't capture everyone
- **Repeated interaction**:firms can sustain higher prices through tacit collusion
- **Quantity competition**: choosing quantities instead of prices changes things fundamentally

Quantity Competition

Cournot Model

Setup:

- Two firms produce a **homogeneous** good
- Each firm simultaneously chooses a **quantity**
- Market price determined by inverse demand: $P = a - b(q_1 + q_2)$
- Both firms have constant marginal cost c

Key difference from Bertrand: Firms commit to production levels, and the market clears at whatever price equates demand and supply.

Cournot: Firm's Problem

Firm 1 maximizes:

$$\pi_1 = P \cdot q_1 - c \cdot q_1 = [a - b(q_1 + q_2)]q_1 - cq_1$$

FOC:

$$\frac{\partial \pi_1}{\partial q_1} = a - 2bq_1 - bq_2 - c = 0$$

Best response function:

$$q_1^*(q_2) = \frac{a - c}{2b} - \frac{q_2}{2}$$

By symmetry: $q_2^*(q_1) = \frac{a-c}{2b} - \frac{q_1}{2}$

Cournot: Solving for Equilibrium

In a symmetric equilibrium, $q_1 = q_2 = q^*$:

$$q^* = \frac{a-c}{2b} - \frac{q^*}{2} \implies q^* = \frac{a-c}{3b}$$

Total output: $Q^* = 2q^* = \frac{2(a-c)}{3b}$

Price: $P^* = a - bQ^* = \frac{a+2c}{3}$

Profit per firm: $\pi^* = (P^* - c)q^* = \frac{(a-c)^2}{9b}$

Note: $P^* > c$, so firms earn positive profits unlike Bertrand!

Cournot vs. Competition vs. Monopoly

	Price	Total Output	Profit
Competition	c	$(a-c)/b$	0
Cournot	$(a+2c)/3$	$2(a-c)/(3b)$	$(a-c)^2/(9b)$
Monopoly	$(a+c)/2$	$(a-c)/(2b)$	$(a-c)^2/(4b)$

Cournot lies **between** competition and monopoly.

Worked Example

Demand: $P = 100 - Q$, where $Q = q_1 + q_2$. Both firms have $MC = 20$.

Firm 1's best response:

$$q_1^* = \frac{100 - 20 - q_2}{2} = 40 - \frac{q_2}{2}$$

Symmetric equilibrium: $q^* = 40 - q^*/2 \implies q^* = 80/3 \approx 26.67$

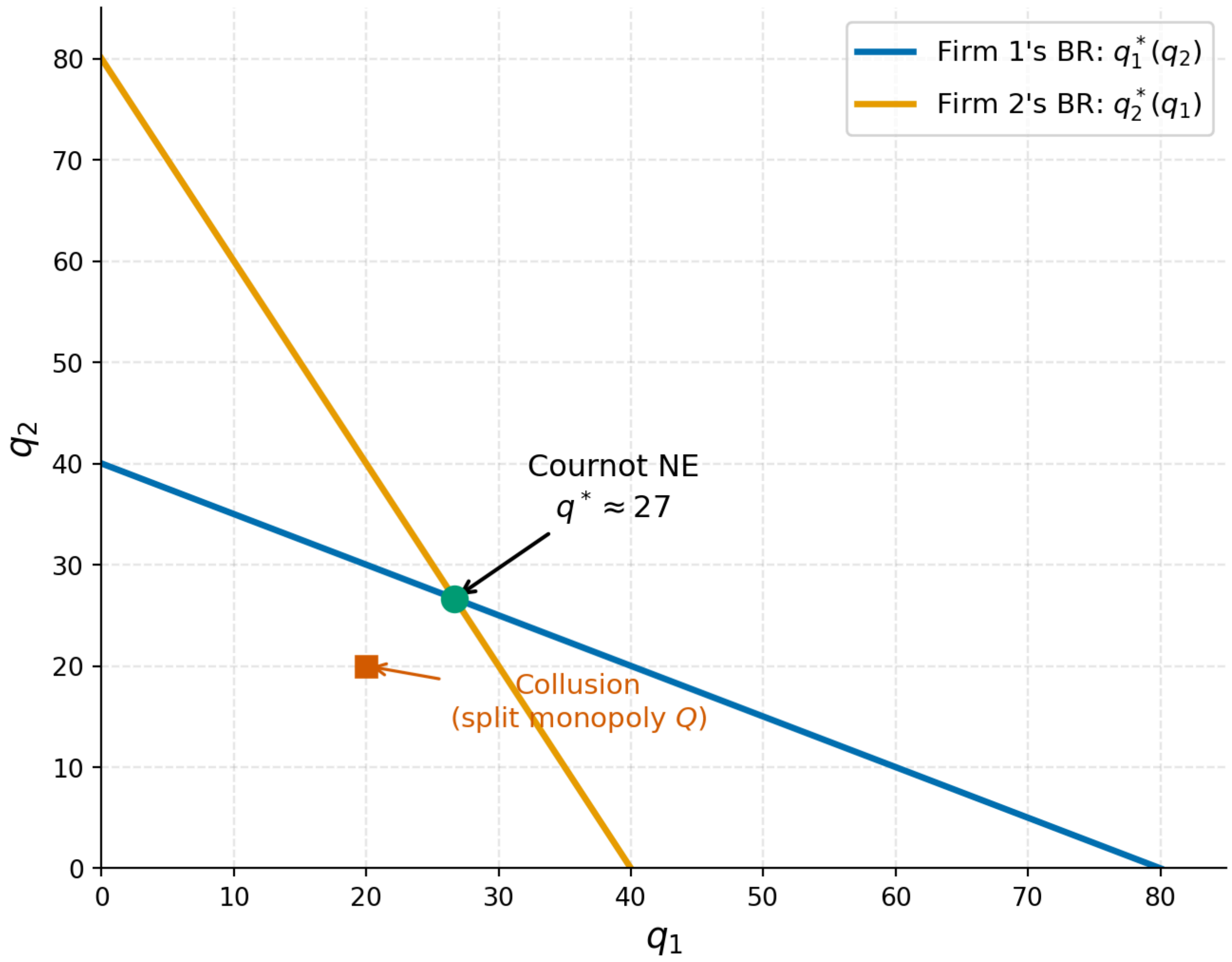
Total output: $Q^* \approx 53.33$

Price: $P^* \approx \$46.67$

Profit per firm: $\pi^* = (46.67 - 20)(26.67) \approx \$711$

Compare: Monopoly profit = $\$1{,}600$, so total Cournot profit ($\$1{,}422$) is less.

Cournot: Best Response Functions



Why Is the Collusion Point Not an Equilibrium?

At the collusion point, each firm produces $q_m/2 = 20$ and earns $\$800$.

But from firm 1's perspective: If firm 2 is producing 20, firm 1's best response is:

$$q_1^* = 40 - \frac{20}{2} = 30$$

Firm 1 can earn **more** by producing 30 instead of 20. Each firm has an incentive to **cheat** on the collusive agreement. This is essentially a **Prisoner's Dilemma** (we will talk about this more when we cover game theory).

Cournot with n Firms

With n identical firms, the symmetric equilibrium:

$$q^* = \frac{a-c}{(n+1)b}, \qquad Q^* = \frac{n(a-c)}{(n+1)b}, \qquad P^* = \frac{a+nc}{n+1}$$

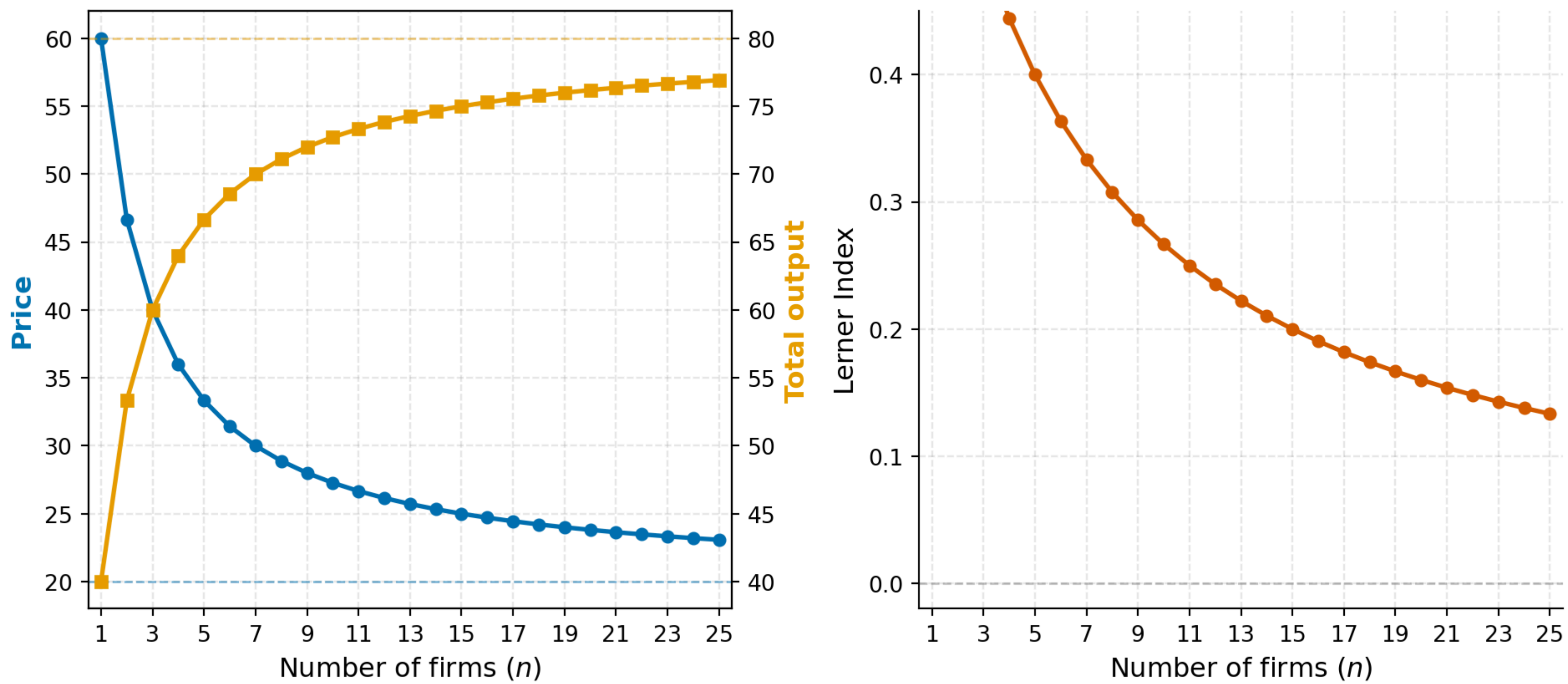
Lerner index:

$$L = \frac{P^* - c}{P^*} = \frac{a-c}{a+nc}$$

As $n \to \infty$: $P^* \to c$ **converges to perfect competition**

As $n = 1$: reduces to **monopoly**

Convergence to Competition



Market power decreases rapidly with the number of firms. Even 4–5 firms gets most of the way to the competitive outcome.