AP Microeconomics Study Guide

Unit 4: Imperfect Competition

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Introduction: Beyond Perfect Competition

Imperfect competition exists whenever a market violates the assumptions of perfect competition (many firms, identical products, no barriers to entry). We move from firms being **price takers** to firms being **price searchers** or **price makers**, meaning they have a downward-sloping demand curve and must choose their price.

1 Monopoly

Characteristics

A pure monopoly is a single firm that is the sole seller of a product with no close substitutes.

- **Single Seller:** The firm IS the industry.
- **Unique Product:** No close substitutes.
- **High Barriers to Entry:** The key. Barriers can be natural (**natural monopoly** due to economies of scale), government-created (patents, licenses), or resource-based (control of a key input).

Profit Maximization (The Quantitative Core)

A monopolist faces the market demand curve. To sell more, it must lower its price, leading to the crucial consequence: **Marginal Revenue (MR) is less than Price (P)**.

The Intuition for $MR < P$: This happens because of the **price effect**. To sell one more unit, the monopolist must lower the price *for all units* (not just the last one). The revenue gained from the new unit (**output effect**) is always partially offset by the revenue lost on all previous units (**price effect**).

Quantitative Rule: For a linear demand curve, the MR curve will always be **twice as steep** as the demand curve, originating from the same vertical intercept. (See Appendix for derivation.)

The Profit-Maximizing Rule: The monopolist maximizes profit by producing the quantity Q^* where:

$$MR = MC$$

1. Find the quantity Q^* where the MR and MC curves intersect.
2. Go **up** from Q^* to the **Demand Curve** to find the profit-maximizing price, P_m.
3. Find the Average Total Cost (ATC) at Q^*.
4. Profit is calculated as: $\Pi = (P_m - ATC) \cdot Q^*$.

Efficiency and Deadweight Loss

- **Allocative Inefficiency:** The monopolist produces where $P_m > MC$. Output is restricted to maintain a higher price, leading to a misallocation of resources ($P = MC$ is the efficient point).
- **Deadweight Loss (DWL):** The triangle of lost surplus (consumer and producer) resulting from the restricted output (Q^*) compared to the efficient output (where $P = MC$).

Perfect Price Discrimination: A single-price monopoly is inefficient. However, if a monopolist can engage in **1st-degree (perfect) price discrimination**, charging each consumer their maximum willingness to pay, the firm's MR curve effectively becomes the D curve.

- The firm produces where $P = MC$, meaning output is **allocatively efficient** (**no deadweight loss!**).

- The firm captures 100% of the total surplus (Consumer Surplus is zero).

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2 Monopolistic Competition

Characteristics

This market structure combines elements of monopoly and perfect competition.

- **Many Firms** and **Low Barriers to Entry:** Like perfect competition.
- **Differentiated Products:** The key. Firms use branding, quality, or location to create a "mini-monopoly" over their specific variety, giving them a downward-sloping demand curve.

Short-Run and Long-Run Equilibrium

- **Short Run:** The firm behaves exactly like a monopolist, maximizing profit where $MR = MC$, and setting price from the demand curve ($P > MC$).
- **Long Run:** If profits are positive, new firms enter (low barriers). This entry shifts the demand curve of existing firms to the **left** until it is just **tangent** to the ATC curve.
- **Long-Run Outcome:** $P = ATC$, resulting in **zero economic profit**.

Efficiency

- **Allocative Inefficiency:** In the long run, $P > MC$, so DWL still exists.
- **Productive Inefficiency:** The firm produces where $P = ATC$ at the tangency point, which is **not** at the minimum of ATC.
- **Excess Capacity Theorem:** The difference between the firm's long-run output and the output at the minimum of ATC is called "excess capacity."

The Value of Variety: While technically inefficient ($P > MC$ and $P \neq \min ATC$), many economists view the resulting DWL as the small trade-off for the massive benefit of **product variety** and consumer choice.

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3 Oligopoly and Game Theory

Characteristics

A market dominated by a few large, profitable firms.

- **Few Large Firms:** (e.g., cell phone carriers, car manufacturers).
- **Interdependence:** The **defining** characteristic. Each firm's profit depends not just on its own actions, but also on the actions of the rival firms. This leads to strategic decision-making.
- **High Barriers to Entry:** Necessary to maintain the "few large firms" structure.

Game Theory Basics

Game theory models strategic interdependence using a payoff matrix.

- **Payoff Matrix:** A table showing the profits for each firm for every possible combination of strategies.
- **Dominant Strategy:** A strategy that yields the highest payoff for a player, **regardless** of what the other player chooses.
- **Nash Equilibrium:** An outcome where no player has an incentive to **unilaterally** change their strategy. This is the non-cooperative, stable outcome.

Example: The Prisoner's Dilemma Two firms, A and B, must decide whether to Price Low (compete) or Price High (collude). (Payoffs: Firm A, Firm B)

		Firm B
	Price Low	Price High
Firm A: Price Low	(\$10, \$10)	**(\$30, \$0)**
Firm A: Price High	**(\$0, \$30)**	(\$20, \$20)

In this case, **Price Low** is the dominant strategy for both firms, leading to the Nash Equilibrium (\$10, \$10), which is worse for both than the cooperative outcome (\$20, \$20). This illustrates the incentive to cheat on collusion.

Bertrand vs. Cournot The **Bertrand Model** (price competition) with identical products predicts that the price will fall to $P = MC$ (the perfectly competitive outcome) even with only two firms, due to fierce undercutting. The **Cournot Model** (quantity competition) predicts an outcome between monopoly and perfect competition. This illustrates how the *type* of competition (price vs. quantity) matters more than the number of firms in some cases.

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4 Efficiency Comparisons Across Market Structures

Table 1: Market Structure Long-Run Comparison

Characteristic	**Perfect Comp.**	**Monopolistic Comp.**	**Oligopoly**	**Monopoly**
Number of Firms	Very Many	Many	Few	One
Product Type	Identical	Differentiated	Identical or Diff.	Unique
Barriers to Entry	None	Low	High	Very High
Long-Run Profit (Π)	$\Pi = 0$	$\Pi = 0$	$\Pi \geq 0$	$\Pi \geq 0$
Allocative Eff? ($P = MC$)	**Yes**	No ($P > MC$)	No ($P > MC$)	No ($P > MC$)
Productive Eff? ($P = \min ATC$)	**Yes**	No (Excess Capacity)	No	No
Deadweight Loss (DWL)	**None**	Yes	Yes	Yes

Key Takeaway: Only perfect competition achieves both allocative and productive efficiency. All imperfectly competitive markets fail on both counts and generate deadweight loss (DWL).

Dynamic Efficiency: Economists like Joseph Schumpeter argued that the high, short-term profits of monopolies are the necessary fuel for **innovation**. Firms pursue monopoly status to gain high profits, driving a process of **creative destruction** where new innovations replace old ones. This long-run technological progress is a form of **dynamic efficiency** that static models of DWL fail to capture.

A Appendix: Quantitative Derivations

Derivation of $MR < P$ for a Monopolist

Total Revenue (TR) is defined as $TR = P \cdot Q$. For a monopolist, Price P is a function of Quantity Q, represented by the demand function $P(Q)$.

$$TR = P(Q) \cdot Q$$

Marginal Revenue (MR) is the change in TR with respect to a change in Q, $\frac{d(TR)}{dQ}$. Using the product rule from calculus:

$$MR = \frac{d(TR)}{dQ} = \underbrace{\frac{dP}{dQ} \cdot Q}_{\text{Price Effect}} + \underbrace{P(Q) \cdot 1}_{\text{Output Effect}}$$

Since the demand curve is downward sloping, the term $\frac{dP}{dQ}$ is negative.

$$MR = P + (\text{a negative number})$$

Therefore, $MR < P$.

Derivation of the "Twice as Steep" Rule

Consider a linear demand curve (inverse demand function):

$$P = a - bQ$$

where a is the vertical intercept and $-b$ is the slope.

1. **Total Revenue (TR):** Substitute P into the TR equation:

$$TR = P \cdot Q = (a - bQ)Q = aQ - bQ^2$$

2. **Marginal Revenue (MR):** Take the first derivative of TR with respect to Q:

$$MR = \frac{d(TR)}{dQ} = a - 2bQ$$

Conclusion: The MR equation $(a - 2bQ)$ has the same vertical intercept (a) as the demand equation $(a - bQ)$, but its slope is $-2b$, which is twice as steep as the demand curve's slope $(-b)$.