Market structure 1: Perfect Competition

The perfectly competitive firm is a **price taker**: it cannot influence the price that is paid for its product.

This arises due to consumers’ indifference between the products of competing firms → for example, buy from store with lowest price. Consumers’ indifference arises from:

- Product homogeneity
- Consumers have perfect information
- No transactions cost
- Many firms

PC firm faces horizontal demand curve at market price $p$
PC firm’s profit maximization problem

- \( \max_q \pi(p) = pq - C(q) \)
- First-order condition: \( p = C''(q) = MC(q) \)
- Second-order condition: \( C'''(q) > 0 \), satisfied if \( MC(q) \) is an increasing function
- If \( p \uparrow \), production rises along \( MC(q) \) curve: \( MC(q) \) is the “supply curve” of the firm.
PC firm’s shutdown decisions

- A firm produces only when its profits from producing exceed the costs it would avoid by not producing

- In **short-run**: avoidable costs do not include sunk costs. Shut down when revenues fall short of avoidable costs
  \[ pq < \text{Avoidable costs}(q) \]
  Consider two cases:
  1. All fixed costs are sunk. Avoidable costs = \( VC(q) \): shut down once \( p < AVC(q) (< AC(q)) \).
  2. Proportion \( \alpha \) of fixed costs not sunk. Avoidable costs = \( VC(q) + \alpha F \): shut down once \( p < AVC(q) + \frac{\alpha F}{q} \)

- In **long-run**: avoidable costs include sunk cost. Shut down when \( pq < C(q) \implies p < AC'(q) \)

- Short-run supply curve? Long-run supply curve? Graph.
The perfectly-competitive industry: Short run

In the short run:

- Number of firms fixed
- Industry supply curve: sum of individual firms’ short-run supply curves. Zero supply at prices below shutdown point. Graph.
- Industry demand curve: downward sloping. Graph.
- Price determined by intersection of industry demand and supply curves. Graph.
- In short-run equilibrium: positive profits for each firm as long as $p > AC(q)$. 

The perfectly competitive industry: Long-run

- Number of firms can vary

- **Free entry and exit:**
  Any short-run profits soaked up by new firms in long-run $\rightarrow$
  Price is driven down to the minimum of the AC curve

- Long-run industry supply curve: horizontal at minimum of the average cost curve
  LR supply curve may be upward-sloping if min AC is rising in market demand $Q$ (due, for example, to resource scarcity)
Elasticities and the residual demand curve

Contradiction between downward-sloping industry demand curve and horizontal demand curve faced by the individual firm?

- Price elasticity of demand:

$$\epsilon \equiv \frac{\Delta q(p) p}{\Delta p q}$$

$$= \frac{\partial \log q(p)}{\partial \log p}$$

$$= \frac{\partial q(p)}{\partial p} \frac{p}{q(p)}$$

Steep demand curves are *inelastic*
Flat demand curves are *elastic*

- Residual demand: \( D_r(p) = D(p) - S_o(p) \).
At competitive equilibrium, firm i’s residual demand elasticity is:
\[ \epsilon_i = \epsilon n - \eta_0 (n - 1) \] where \( \eta_0 \) is the “residual supply” elasticity:
\[ \eta_0 = \frac{\partial S_0(p)}{\partial p} \frac{p}{S_0(p)} \]

Inelastic industry demand (low \( |\epsilon| \)) consistent with elastic residual demand curve (high \( |\epsilon_i| \)) as \( n \) increases

Example
- market demand \( Q = 100 - p \)
- 50 firms, each with supply curve \( q = p \)
Desirability of PC outcome

\[ p = MC(q) = \min_q AC(q) \]

- Production at \( p = MC(q) \): firm produces an additional unit only if it can cover the production costs. *Producer surplus* is maximized.

- Value placed on marginal unit of the good \( p \) exactly equals the cost of producing that marginal unit (*consumption efficiency*). *Consumer surplus* is maximized.

- Production at minimum average cost: no better alternative use of resources is possible (*production efficiency*). In other words, each firm operating at minimum efficient scale.
Barriers to Entry

Nice outcome in perfect competitive world depends crucially on free-entry assumption. Fixed costs of entry are present in many markets: are they a barrier to entry??

- Fixed costs borne equally by all firms: accommodated by free entry assumption
  Example: salt factory, advertising?

- Fixed costs which affect entrant firms disproportionately: barriers to entry
  Example: First mover advantage.
  \[ C_1(q) = F + VC(q), \quad C_2(q) = 2F + VC(q) \]
  Microsoft: computer operating systems?

Next focus on extreme case where entry ruled out: monopoly
Market structure 2: Monopoly

- Industry has one firm, who faces downward-sloping industry demand curve

- **Market power**: ability of a firm to dictate market prices in an industry. Depends on the slope of the residual demand curve.

- Market power is “opposite” of price-taking behavior
Monopoly and profit maximization

Two equivalent formulations

1. Monopolist chooses quantity to maximize profits
   - \( \max_q p(q)q - C'(q) = \text{Revenue}(q) - C(q) \)
   - Graph. Quantity can be increased only if price is lower. Tradeoff between increased demand versus revenue lost on consumers who would have bought even under the higher price
   - FOC: \( R'(q) = p(q) + p'(q)q = C'(q) \leftrightarrow MR(q) = MC(q) \). Graph.
2. Monopolist chooses price to maximize profits
   
   - \( \max_p pq(p) - C(q(p)) \), where \( q(p) \) is demand curve.
   - FOC: \( q(p) + pq'(p) = C'(q(p))q'(p) \)
   - At optimal price \( p^* \), **Inverse Elasticity Property** holds:
     \[
     (p^* - MC(q(p^*))) = -\frac{q(p^*)}{q'(p^*)} \quad \text{or} \quad \frac{p^* - mc(q(p^*))}{p^*} = -\frac{1}{\epsilon(p^*)},
     \]
     where \( \epsilon(p^*) = q'(p^*) \frac{p^*}{q(p^*)} \).
   - Across monopolistic markets, should observe negative relationship between price and demand elasticity
   - If \( \epsilon \to +\infty \): \( p = MC(q) \)
   - Example: \( q(p) = 10 - q \)
   - What if \(-1 < \epsilon(p^*) < 0\)? Implies \( p^* < 0 \) so monopolist will never produce at this point. (See handout).
How monopolies arise

Crucial aspect of monopoly: price-setting ability (relatively inelastic demand curve)

- Product differentiation
- Superior production technology
- Government-granted monopolies
Is monopoly good or bad?

- Negative aspects of monopoly
  - At monopoly solution, $p > MC$. Graph. Deadweight loss from
    1. consumer surplus (consumers whose valuations lie between $p(q^M)$ and $p(q^{PC})$ do not buy the product
    2. producer surplus (units with marginal cost between $MC(q^M)$ and $MC(q^{PC})$ are not produced.
  - This deadweight loss is greater the more inelastic ("steeper") demand is.
Positive aspects of monopoly

- Demsetz critique: monopolist is the firm with lowest-cost technology. Monopolist “deserves” its market leadership.
- Schumpeter: monopoly profits provide an incentive for innovation and technological change (“process of creative destruction”)
- Natural monopoly: industry characterized by increasing returns to scale.

Government antitrust policy: balance these aspects

Checks on a monopolist’s market power: threat of entry keeps price around average cost
Summary

1. Perfect competition
   - Individual firm takes prices as given in making output decisions
   - Shutdown decisions: long run vs. short run
   - Industry equilibrium: in long-run $p = MC(q) = \min_q AC(q)$

2. Monopoly
   - Firm has power to set both quantity and price
   - Tradeoff between higher demand but lower per-unit prices
   - $MR(q^*) = MC(q^*)$; inverse-elasticity pricing property

Next week, consider intermediate case of an industry with several firms: **Oligopoly**