

## 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  $\implies$  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  
 $\iff pq < \text{Avoidable costs}(q)$ .

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  $\implies$   
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:

$$\begin{aligned}\epsilon &\equiv \frac{\Delta q(p)}{\Delta p} \frac{p}{q} \\ &= \frac{\partial \log q(p)}{\partial \log p} \\ &= \frac{\partial q(p)}{\partial p} \frac{p}{q(p)}\end{aligned}$$

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.

$$C_1(q) = F + VC(q), C_2(q) = 2F + VC(q)$$

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:  
$$(p^* - MC(q(p^*))) = -\frac{q(p^*)}{q'(p^*)}$$
 or 
$$\frac{p^* - mc(q(p^*))}{p^*} = -\frac{1}{\epsilon(p^*)}$$
,  
where  $\epsilon(p^*)$  is  $q'(p^*) \frac{p^*}{q(p^*)}$ .
- Across monopolistic markets, should observe negative relationship between price and demand elasticity
- If  $\epsilon \rightarrow +\infty$ :  $p = MC(q)$
- 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**