

## Unit 3: Producer Theory

- Lecture 8: Production
  - I. Production Functions
    - $Q = f(L, K)$ ;
  - II. Short Run Production
    - there is a fixed factor of production, usually capital (plant size is fixed in SR);
  - III. Long Run Production
    - all factors are variable;
  
- Lecture 9 - Production & Costs
  - I. Productivity
  - II. Costs
    - Fixed cost = cost on fixed factor;
    - Variable cost = cost on variable factor;
    - Total cost = Fixed cost + Variable Cost;
    - Marginal cost = additional cost of producing one more unit,  $MC = \frac{\Delta TC}{\Delta Q}$ . If total cost function is differentiable, then  $MC = \frac{dTC}{dQ}$ .
    - Average cost = cost per unit of output;
  - III. Long Run Cost Curves
    - all factors variable, factor input demand is such that  $MRTS = \frac{w}{r}$ , tangency between isoquant and isocost curve determines optimal mix of inputs and minimum cost of production;
    - Marginal cost and Average cost defined in the same way;
    - LRAC is the lower envelope of SRAC for different plant sizes, i.e. LR cost of production lower than SR cost of production.
    - LRAC=SRAC implies SRMC=LRMC.
    - economies of scale and scope.
  
- Lecture 10 - Competition
  - I. Perfect Competition
    - firms and consumers are price takers;
    - symmetric information;
    - no transaction costs;

- free entry and exit in the long run;

## II. Short Run Profit Maximization

- firm maximizes profits by producing output where  $MR = MC$ ;
- competitive firm faces a perfectly elastic demand curve,  $MR = P$ . Hence, for a perfectly competitive firm,  $P = MC$ ;
- in short run firms use short run cost curves (SRMC, ATC, AVC) to make profit maximization and shut down decisions;
- firm shuts down if  $P < \min AVC$ ;
- derive individual firm short run supply curve using  $P = MC$  and  $Q = 0$  (shut down) for  $P < \min AVC$ .
- SR market supply curve is horizontal sum of individual firm SR supply curves.
- industry profits can be positive or negative in SR.

### • Lecture 11 - Competition II

#### I. Competition in the Long Run

- in LR free entry and exit drives economic profits to 0, i.e.  $P = MC = AC$ . Hence, LR industry supply curve is perfectly elastic at  $P = \min AC$  and each firm produces at  $q = \arg \min AC$ ;
- with barriers to entry, problem is as in the SR only firms use their LR cost curves; LR individual supply curve with barriers to entry is LRMC curve above minimum of AC and 0 below.
- SR supply less elastic than LR supply with entry barriers, which is less elastic than LR supply with free entry.
- Increasing input prices can lead to an upward sloping LR supply curve even with free entry;

## Unit 4: Welfare Economics

### • Lecture 12 - Competition III

#### I. Do Firms Maximize Profits?

- agency problem when manager of firm does not own full stake in the firm;
- align incentives by using stock options and other payment schemes - can lead to excessive risk taking and short term behavior;

### • Lecture 13 - Welfare Economics

#### I. Consumer Surplus

- demand curve represents marginal willingness to pay for good;
- area under demand curve and above the price is the value from consuming the good in monetary terms - consumer surplus;

## II. Producer Surplus

- supply curve comes from marginal cost of production;
- area above supply curve and below price is net benefit to producers - producer surplus;

## III. Competition Maximizes Welfare

- total welfare (CS+PS) maximized when demand=supply, i.e. at perfectly competitive output level;
- any other output level leads to a deadweight loss (gains from trade that are left unexploited);
- government policies done for redistributive reasons or to raise tax revenues;

## IV. Government policies

- price controls (price ceiling);
- price support/minimum wage (price floor);
- import tariffs/quotas;
- unit tax/subsidy;

# Unit 5: Monopoly and Oligopoly

## • Lecture 14 - Monopoly I

### I. Monopoly Profit Maximization

- total revenue is  $TR = P(Q) \cdot Q$ ;
- average revenue for a firm is given by demand curve,  $AR = P(Q)$ ;
- marginal revenue is additional revenue from selling one more unit,  $MR = \frac{\Delta TR}{\Delta Q}$  or if revenue function is differentiable,  $MR = \frac{dTR}{dQ}$ .
- perfectly competitive firm faces a perfectly elastic demand curve,  $P(Q) = P$  and hence,  $MR = P = AR$ .
- monopoly faces downward sloping demand curve and hence  $MR = P(Q) + Q \cdot \frac{dP}{dQ} < P(Q)$  since  $\frac{dP}{dQ} < 0$ .
- monopolist has to decrease price on all units sold in order to sell one additional unit. Not the case with a perfectly competitive firm, which cannot influence the price at which it sells.
- MR curve for monopolist is below AR curve (the demand curve).
- $MR = P(Q) + Q \cdot \frac{dP}{dQ} = P(Q)(1 + \frac{Q}{P(Q)} \frac{dP}{dQ}) = P \cdot (1 + \frac{1}{\epsilon_D})$ . For  $|\epsilon_D| < 1$ ,  $MR < 0$  and so a monopoly never produces at the inelastic part of the demand curve.
- Profit maximization  $\implies MR = MC$ . Hence,  $P \cdot (1 + \frac{1}{\epsilon_D}) = MC$  or  $\frac{P-MC}{P} = -\frac{1}{\epsilon_D}$ : mark-up, measure of monopoly power.
- Shut down decision is like that of a competitive firm.

### II. Welfare Effects of Monopoly

- Because  $MR < AR$ , monopolist would supply less than the socially optimal (welfare maximizing) level of output, which leads to a deadweight loss;

- Lecture 15 - Monopoly II

- I. Price Discrimination

- above analysis is for a uniform pricing monopoly - the monopolist sets the same price for every unit sold or for every consumer type.
    - monopolist can price discriminate - set different prices for different units, charge different uniform prices for different consumer groups, use two part tariffs, etc.
    - perfect price discrimination/1st degree price discrimination - monopolist charges each consumer their willingness to pay for the good, and hence extracts all the consumer surplus. MR curve is now the AR curve, i.e. the demand curve. Set output where new MR curve equals MC, i.e. where demand intersects MC.
    - hence, a perfectly price discriminating monopolist produces the socially optimal output level.

- II. How do Monopolies Arise?

- cost advantages - natural monopoly, for any output produce at lower AC than any other firm can (AC is declining);
    - barriers to entry - fixed costs, patents;

- III. Regulating Monopolies

- Government regulation of monopoly, through a price ceiling can improve welfare. Setting a price ceiling at the competitive price leads to zero DWL.
    - Effect of a unit tax on the price of good - price of good can increase by less than 1 for 1 with the tax or by more - difference with perfectly competitive market.

- IV. Contestable Markets

- threat of entry “disciplines” monopolist and they charge a price close to the perfectly competitive price.

- Lecture 16 - Other Market Structures

- I. Oligopoly

- small number of firms that interact strategically (not price takers but have to take into account other firms’ decisions when making their own decisions);
    - duopoly - market with two firms;

- II. Game Theory

- study of the outcome of strategic interactions;
    - player’s objective is to maximize payoffs given actions of others;
    - non-cooperative games - players cannot enforce mutually beneficial strategies;
    - strategies - possible actions that players choose from to maximize payoffs;
    - dominant strategy - strategy that maximizes a player’s payoff no matter what the other player does;
    - Nash equilibrium - each player is doing the best it can (maximized payoff) given the actions of its opponents;

### III. Cournot Model of Noncooperative Equilibrium

- Cournot duopoly - two firms compete by setting **output** levels **simultaneously**. Each firm treats the output of its competitor as fixed;
- Reaction curve - relationship between firm's profit maximizing output and output it thinks its competitor will produce;
- Cournot equilibrium - Nash equilibrium of Cournot duopoly game. Output levels for which reaction curves intersect.

## Lecture 17: Oligopoly Continued (Chapter 12)

### I. Cournot Math

- Cournot: All firms set quantities at the same time
- Calculate residual demand for a given firm and solve its profit maximization problem to find its best response function to other firms' output decisions.
- Solution is a set of quantities (one for each firm) that solves this system of equations.

### II. Cooperative Equilibrium - Cartels

- Firms can form a cartel and behave like a single monopolist, maximizing total industry profits.
- Cartels are unusual because they are fundamentally unstable (incentive to "cheat" and raise own production) and because they are illegal (antitrust laws).

### III. Comparing Equilibria

- In terms of welfare, usually Perfect Competition > Oligopoly > Monopoly
- Quantity as an indicator of social welfare
- DWL in welfare analysis comes from trades that aren't made

### IV. Many Firms

- In Cournot, as number of firms  $\rightarrow \infty$ , Cournot equilibrium approaches competitive equilibrium
- As number of firms  $\rightarrow 1$ , approaches monopoly
- Markup over competitive price depends on number of firms and elasticity of demand:

$$\frac{p - MC}{p} = -\frac{1}{n\epsilon}$$

### V. Price Competition

- Bertrand: firms set prices (instead of quantities) at the same time
- Two firms may be enough to remove market power (i.e. restore competitive outcome) if products are identical
- Recall proof from class that identical Bertrand duopolists drive price down to marginal cost
- Also recall the Stackelberg model where one firm set their quantity before the other firm. In this case, the best response function for the Stackelberg leader takes into account the fact that the follower will respond to the leader's output decision.

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