

Economics 326: Monopoly

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Outline

1. Monopoly: Theory
2. Monopoly: An Example
3. Price Discrimination

1 Monopoly: Theory

- We now relax the assumption that the firm takes the price as given.

- There are many ways we can do this. In general, this is called imperfect competition. We can have a few firms competing. This is called oligopoly. We can also have only one firm in the market. This is called monopoly.
- What are examples of imperfect competition?
- What determines market structure (the degree of competition: perfect competition, monopoly, oligopoly, monopolistic competition)?
 - Legal rules (anti-trust laws, etc..).
 - Technology (it may not be possible for an increasing returns to scale firm to profitably operate in a competitive environment).
- Monopolist maximizes profits:

$$PQ - C(Q)$$

- What prevents the monopolist from charging an infinite amount? Demand. They can't sell as much as they want at a given price.
- So we add a demand equation:

$$Q = D(P)$$

shorthand : $Q(P)$

- Two ways to handle the demand constraints:
 1. Substitute the demand equation for the quantity

$$\Pi(P) = PQ(P) - C(Q(P))$$

2. Substitute the inverse of the demand equation (price as a function of quantity) into the price:

$$\Pi(Q) = P(Q)Q - C(Q)$$

- It is easier to show what we want to show by substituting in the inverse demand function. We then take first order conditions:

$$\frac{d\Pi}{dQ} = P(Q) + Q \frac{dP}{dQ} - \frac{dC}{dQ} = 0$$

- With a competitive firm, the effect of increasing a unity of production is that the firm sells another unit at price P (marginal revenue) and its costs increase by one unit of production (marginal cost). Here there is a third effect:

$$Q \frac{dP}{dQ}$$

- This third effect is that the increased production leads to a change in price and that changes revenues to the firm on all units sold (Q). Notice that $\frac{dP}{dQ}$ is from the demand side and so is negative. Therefore price plus something negative is equal to marginal cost:

$$P(Q) + Q \frac{dP}{dQ} = \frac{dC}{dQ}$$

- In other words, price is above marginal cost (and thus quantity demanded is below what it would be in a competitive market)!
 - Note that since $P > MC$, if the firm could produce another unit of production without it impact the price in the market (as with a competitive firm), it would do so.

- We now continue with our derivation:

$$\begin{aligned} & \implies p(Q) - \frac{dC}{dQ} = -Q \frac{dP}{dQ} \\ \frac{P(Q) - \frac{dC}{dQ}}{P(Q)} &= -\frac{Q dP}{P dQ} \end{aligned}$$

- The markup of a good over marginal cost is the fraction of the price charge that is above marginal cost:

$$\frac{P(Q) - \frac{dC}{dQ}}{P(Q)}$$

- The inverse elasticity of demand is

$$\frac{dP}{dQ} \frac{Q}{P}$$

- So a monopolist sets price as a markup over the marginal cost of production:

$$\frac{P(Q) - \frac{dC}{dQ}}{P(Q)} = -\frac{Q}{P} \frac{dP}{dQ} = -\frac{1}{\epsilon_D}$$

1. Price rises lead to quantity declines. Therefore, the demand elasticity is negative. This means that the markup is positive.
2. The more inelastic the demand, the more consumers don't have substitution possibilities. Therefore, the more the firm is able to raise prices without a reduction in demand. As the elasticity goes to zero (completely inelastic), the markup goes towards infinity.

- Show graph.

2 Monopoly: An Example

- A toy manufacturer produces according to the following cost function:

$$TC = 10X_S$$

where X is the number of units of production.

- Market demand for the toy is given by:

$$X_D = 100 - 5P$$

- Constructing the inverse demand function, we get:

$$P = \frac{100 - X_D}{5} = 20 - \frac{X_D}{5}$$

- The firm then maximizes

$$\begin{aligned} & P(Q)Q - C(Q) \\ &= \left(20 - \frac{X_D}{5}\right) X_D - 10X_D \end{aligned}$$

- Taking first order conditions, we get:

$$\begin{aligned} \frac{d\Pi}{dX_D} &= 20 - \frac{2}{5}X_D - 10 = 0 \\ \implies 10 &= \frac{2}{5}X_D \\ \implies X_D^* &= 25 \\ \implies P^* &= 20 - \frac{25}{5} = 15 \end{aligned}$$

3 Price Discrimination

- What if firms could

1. Observe every customer's willingness to pay for the good the produce
 2. Legally charge a different price for every customer
- Then the deadweight loss from monopoly would disappear because the firm would no longer face a trade-off between gaining another customer at a price equal to or above cost and lowering the price that it receives from all other customers.
 - However, the firm would then capture all the surplus.
 - This is called first degree price discrimination (show graph).
 - There is also second and third price discrimination.

1. Second degree - offer different prices for different bundles of goods together (i.e. computers with different configurations)
2. Third degree - offer different prices to different demographic groups (legal issues may arise): i.e. discounts for kids or elderly (give discounts to more elastic groups).