Mikro II, lecture 6a

Introduction to monopoly

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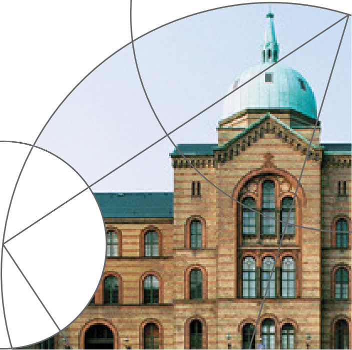


Plan for the lecture

1. Introduction to monopoly
2. The monopolist's profit maximization
3. Consequences of monopoly

Monopoly

- We leave the world of the Principal Agent model and its focus on contracts (complicated goods) and look at markets that can be well described just by a price and traded quantity

- The analysis so far has been based on perfect competition or *price taking*: Buyers / sellers take prices as given when making decisions

- Price taking is a reasonable assumption (approximation) if there are many buyers and sellers: My actions are unimportant for the market price if I am a small part of the market

- We will look at a situation that is almost opposite: A single seller in the market, Monopoly (Monos = one, polein = to sell)

Market demand

- As before, the market has an (inverse) demand curve with a negative slope (coming from many consumers' utility maximizations):

$$D(p) \qquad \text{and} \qquad p(x) = D^{-1}(x)$$

- On the supply side, however, we now have only a single profit maximizing company (monopoly) that has to decide how much it will produce

- Remember from Micro I that we can divide a company's profit maximization problem into two parts:
  1. Cost minimization: Given that I want to produce a certain amount of x and my production function is $x = F(K, L)$ how do I do it in the cheapest way
  2. Given the cost function $C(x)$ as follows from 1), how much do I want to produce (supply)?

Supply side

- Let $R(x)$ be the revenue when selling x units (i.e. just price times quantity)

- Step 2 of the problem becomes:

$$\max_{x} \quad R(x) - C(x)$$

- Assume well behaving functions (R concave, C strictly convex) then an inner solution x^* will be determined by the first-order condition:

$$R'(x) = C'(x)$$

- Standard intuition: Marginal revenue from extra sales must equal marginal cost of extra production $MR = MC$

Perfect competition

- Beforehand, when we have assumed perfect competition and price-taking, the company took the market price p for granted and we have:

$$R(x) = p \cdot x \qquad \text{and} \qquad R'(x) = MR(x) = p$$

- If we insert into the first-order condition: we get the familiar $p = MC$

- But note that if our monopoly seller realizes that she is the only seller then she will realize:
  1. I am the only seller so the x I choose is all that will be traded (the equilibrium amount)
  2. I can therefore calculate the (equilibrium) market price that applies in advance by inserting this into the inverse demand function: $p(x)$
  3. So if I change x, I change the market price $p(x)$ (*not* price taking)

Socrative Quiz Question

True or false: If the demand curve is linear, then the marginal revenue curve of the monopolist may or may not be linear.

Monopoly

- If the company does not take the price for granted but uses the insight from the previous slide, we have:

$$R(x) = p(x)x \qquad \text{and} \qquad R'(x) = MR(x) = p(x) + p'(x)x$$

- Compare with MR under price taking: $p'(x) < 0$ so the monopolist's MR from producing one more unit of the good is less than the price of the good (what it would be under price-taking).

- When the company is considering producing and supplying a unit more, it thinks: If I supply one unit more ...
  - ... I will receive a payment p for it; *both* under price-taking and monopoly
  - ... and I will have to lower the market price by $p'(x)$ for all x other units I already supply; new effect, *only* under monopoly

Graphical analysis, monopoly

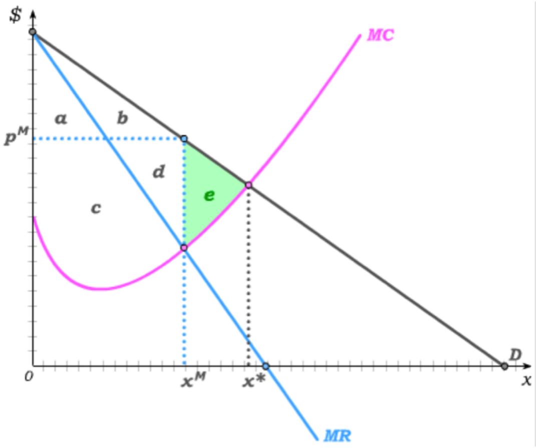
- We can graphically analyze what happens in equilibrium when we have a monopoly (equilibrium = the monopolist has optimized given $p(x)$)

- We saw that the monopolist's choice should meet $MR(x) = MC(x) \Rightarrow$ equilibrium quantity, x^* is found where MR and MC intersect, equilibrium price is found via the demand curve $p^* = p(x^*)$

- What does the MR curve look like? Remember that the following applies $MR(x) = p(x) + p'(x)x$ and $p(x)$ is the inverse demand

- Hence: At $x = 0$ the MR curve is equal to the demand curve and at $x > 0$ the MR curve is below the demand curve

Monopoly results in deadweight loss



- Monopoly means higher price and less quantity than under complete competition: deadweight loss (e)
- A monopolist chooses lower quantity to secure higher price and higher profits
- The monopolist has *market power* over the price

Pitfalls, reminder

- If the profit function $R(x)-C(x)$ is not strictly concave, we can have multiple local maxima or local minima (if R and / or C are ”strange”)
- In that case, the first-order condition may have several solutions (more than one x where $MR(x)=MC(x)$)
- Checking the second-order condition reveals minima (local maximum if $MR'(x)-MC'(x)\leq 0$)
- Actual profit comparison reveals which of the local maxima is the global maximum

Corner solutions, reminder

- Optimum can also be a corner solution without production ($x = 0$) instead of the inner solution x^*
- Divide costs into (recurring) fixed cost and variable costs:
  $C(x) = FC + VC(x)$
- In the short term (fixed costs can be avoided), zero production is optimal if x^* gives negative producer surplus:

$$p(x^*)x^* - VC(x^*) \leq 0 \iff p(x^*) < \frac{VC(x^*)}{x} \quad \Big(= AVC(x^*)\Big)$$

- In the long run ((recurring) fixed costs are inevitable) closing is optimal if x^* yields negative profit:

$$p(x^*)x^* - C(x^*) \leq 0 \iff p(x^*) < \frac{C(x^*)}{x} \quad \Big(= ATC(x^*)\Big)$$

Linear demand I

- Assume linear demand, $p(x) = a - bx$, and constant marginal cost, coming from the linear cost function $C(x) = c \cdot x$ where $c < a$ (otherwise no trades)

- MR for the monopolist: $MR(x) = p(x) + p'(x)x = a - bx + (-b)x = a - 2bx$

- Note the useful result: For linear demand, the MR curve is the same as the demand curve only with double slope

- The first-order condition of the monopolist gives traded quantity and price (the profit function is strictly concave and there are no fixed costs):

$$MR(x^*) = c \iff a - 2bx^* = c \iff x^* = \frac{a-c}{2b}$$

$$p^* = p\left(\frac{a-c}{2b}\right) = \frac{a+c}{2}$$

Example, linear demand II

- Compare with perfect competition equilibrium (where constant MC means perfectly elastic supply)

- Under perfect competition the price becomes equal to MC, so the equilibrium quantity (and price) is given by:

$$p(x^c) = c \iff a - bx^c = c \iff x^c = \frac{a-c}{b}$$

$$p^c = c$$

- We see that monopoly leads to higher price and lower quantity (and also positive profit; otherwise with constant MC $\Rightarrow$ zero profits with price-taking)

Solving for price or quantity?

- So far we have assumed that the monopolist maximizes in terms of quantity x, but perhaps it is more intuitive to think about the company as setting a price?

- Maybe, but the demand curve means there is a one-to-one relationship between price and quantity, so here it makes no difference

- This maximization problem (plus the condition $p^* = p(x^*)$) ...

$$\max_{x} \quad p(x)x - C(x)$$

- ... is equivalent to this one (plus the condition $x^* = D(p)$) (check yourself!):

$$\max_{p} \quad pD(p) - C(D(p))$$

Socrative Quiz Question

True or false: If demand becomes more elastic, the monopolist's profits will increase.

What have we learned?

- The marginal revenue for a monopolist is less than for a seller under perfect competition
- Solving the monopolist's problem
- What monopoly means for price, quantity, profit and welfare relative to perfect competition
- The relationship between the demand curve and the marginal revenue curve when demand is linear