2.1 Monopoly

Matilde Machado

Download the slides from:

http://www.eco.uc3m.es/~mmachado/

2.1 Monopoly

Def: A firm is a Monopoly when it is the only producer or provider of a good which does not have a close substitute. When monopolies occur there are usually *barriers to entry* because otherwise the high profits would attract competitors.

Examples of Barriers to Entry:

1) Economies of scale or Sunk Costs (not recoverable if the firm goes out of business)

2) Patents or licenses

3) Cost advantages (e.g. superior technology or exclusive property of (certain) inputs)

4) Consumer switching costs create product loyalty.

2.1 Monopoly

Example 1: Xerox had a patent which granted the firm a monopoly in the "plain paper copies" (PPC) until 1975.

Example 2: Debeers – the diamond cartel – was so large that at point it controlled 90% of the world's diamonds.

Example 3: In Houston (USA) there were 2 newspapers until 1995, the *Houston Post* and the *Houston Chronicle. The Post* went out of business which brought an increase of 62% in the prices of advertisements at the Chronicle while its sales only rose by 32%.

Example 4: Some public firms, for example Red Eléctrica, are natural monopolies.

2.1 Monopoly

Example of lack of barriers to entry that prevent a firm from keeping its monopoly position :

In 1945 Reynolds International Pen Corporation produced the first ballpoint pen which was based on a patent that had expired. The first day, it sold 10,000 pens at 12,5 USD each (its cost was only 0.8 cents). In the spring of 1946 the firm was producing 30,000 pens daily and had a profit of 1.5 million dollars. By December 1946 100 new firms had entered the market and prices had dropped to 3 dollars. By the end of the 40's each pen was sold at 0.39 cents!

2.1 Monopoly (the standard model)

The Standard Model:

- There is only 1 firm in the market
- The firm faces the whole aggregate demand p=P(Q). Therefore it is aware that $\Delta q \Rightarrow \Delta p$.
  Note: We denote by Market Power a firm's ability to change the equilibrium price through its production (or sales) decisions.

2.1 Monopoly (the standard model)

- Moreover we assume that:
  - The monopolist produces a single product
  - Consumers know the characteristic of the product
  - The demand curve has a negative slope $\frac{dD(p)}{dp} < 0$
  - Marginal costs are non-negative $\frac{dC(q)}{dq} \geq 0$
  - **Uniform pricing** (the same price for all consumers and all units of the good)
  - The monopolist chooses production (or price) to maximize profits

2.1 Monopoly (the standard model)

The monopolist's problem:

$$\underset{q}{Max} \prod = p(q)q - C(q) = \text{TR} - \text{TC}$$

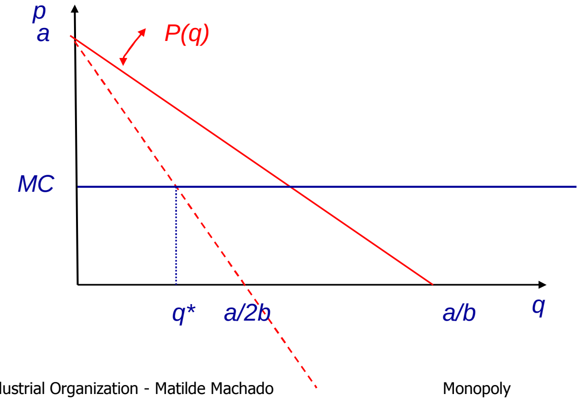
$$\text{FOC: } p(q) + p'(q)q = c'(q) \;\Leftrightarrow\; \text{marginal revenue= marginal cost}$$

Why is the optimum where MR=MC?

2.1 Monopoly (the standard model)

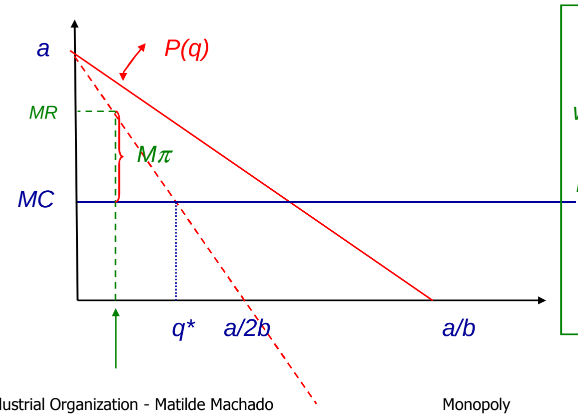
Let's take an example:

P(q)=a-bq; TR=p(q)× q=aq-bq^2; MR=a-2bq



2.1 Monopoly (the standard model)

What would happen if we produced less than q*?



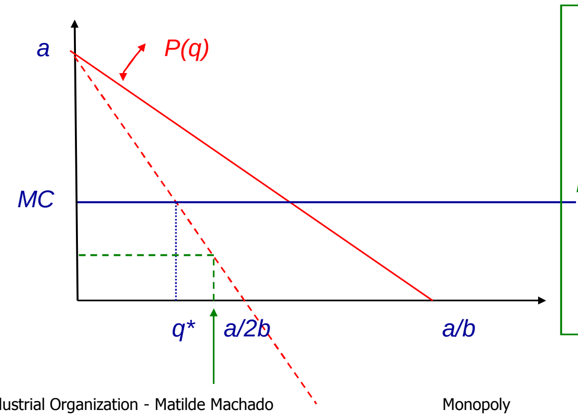
MR>MC that would imply that if we were to produce an extra unit the revenue we obtain is higher than the cost of it, ⇒

Marginal profit = MR-MC>0

⇒ We should increase production. We apply the same argument until MR=MC

2.1 Monopoly (the standard model)

A similar argument if we produced more than q*?



MR<MC that would imply that if we were to produce an extra unit the revenue we obtain is lower than the cost of it, ⇒

Marginal profit = MR-MC<0

⇒ We should decrease production. We apply the same argument until MR=MC

2.1 Monopoly (the standard model)

The monopolist's problem:

$$\underset{q}{Max} \prod = p(q)q - C(q) = \text{TR} - \text{TC}$$

$$\text{FOC: } p(q) + p'(q)q = c'(q) \Leftrightarrow \text{marginal revenue= marginal cost}$$

$$\Leftrightarrow p(q) - c'(q) = -p'(q)q$$

$$\Leftrightarrow \frac{p(q)-c'(q)}{p(q)} = -\frac{\partial p}{\partial q}\frac{q}{p} = \frac{1}{\varepsilon(q)} \quad \text{(A)}$$

The Lerner Index, is a measure of market power. Because it is divided by the price, it allows comparisons across ≠s markets

The Inverse of the demand elasticity

Note: The more elastic is the demand curve the lower is the monopolist market power. For example, if the demand is horizontal (i.e. infinitely elastic), the monopolist does not have any market power and p=cmg.

2.1 Monopoly (the standard model)

Refresh elasticity concept: Examples of Demand Elasticities

- When the price of gasoline rises by 1% the quantity demanded falls by 0.2%, so gasoline demand is not very price sensitive.
  - Price elasticity of demand is 0.2 .
- When the price of gold jewelry rises by 1% the quantity demanded falls by 2.6%, so jewelry demand is very price sensitive.
  - Price elasticity of demand is 2.6 .

2.1 Monopoly (the standard model)

Another useful way of writing the FOC (A) is:

$$\frac{p(q)-c'(q)}{p(q)} = -\frac{\partial p}{\partial q}\frac{q}{p} = \frac{1}{\varepsilon(q)} \qquad (A)$$

$$\Leftrightarrow \quad p(q)\left[1-\frac{1}{\varepsilon(q)}\right] = c'(q)$$

$$\Leftrightarrow \quad p(q) = \frac{c'(q)}{\left[1-\frac{1}{\varepsilon(q)}\right]} > c'(q)$$

If ε(q)>1

2.1 Monopoly (the standard model)

The previous condition shows that the monopolist always chooses to produce in the part of the demand curve where ε(q)>1 since otherwise the marginal revenue would be negative.

Intuitively if ε(q)<1: $\left|\frac{\partial Q}{Q}\right| < \left|\frac{\partial p}{p}\right| \Leftrightarrow |\Delta\%Q| < |\Delta\% p|$

Therefore if the monopolist decreases the quantity sold, the price increases proportionately more, implying an increase in revenues (p×Q) while costs decrease due to the lower production. Conclusion: when ε(q)<1, profits increase when the monopolist reduces quantity. A point where ε(q)<1 cannot be an equilibrium.The monopolist will keep reducing production until profits stop increasing.

2.1 Monopoly (the standard model)

In the case of a monopolist, we may write the maximization problem in terms of quantity or price:

$$\underset{p}{Max} \prod = pD(p) - C(D(p))$$

$$\text{FOC: } D(p) + pD'(p) = C'(D(p))D'(p)$$

$$\Leftrightarrow D'(p)[p - C'(D(p))] = -D(p)$$

$$\Leftrightarrow \underbrace{\frac{p - C'(D(p))}{p}}_{\text{The Lerner Index}} = -\frac{1}{D'(p)}\underbrace{\frac{D(p)}{p} = \frac{1}{\varepsilon(q)}}_{\text{The Inverse of the demand elasticity}}$$

The Lerner Index

The Inverse of the demand elasticity

2.1 Monopoly (the standard model)

An example with linear demand:

$$p(q) = a - bq$$

$$TR = p(q) \times q = aq - bq^2$$

$$MR = \frac{\partial TR}{\partial q} = a - 2bq$$

$$\varepsilon(q) = -\frac{\partial q}{\partial p} \times \frac{p}{q} = \frac{1}{-\frac{\partial p}{\partial q}} \frac{p}{q} = \frac{1}{b}\frac{p}{q} = \frac{a - bq}{bq} = \frac{a}{bq} - 1$$

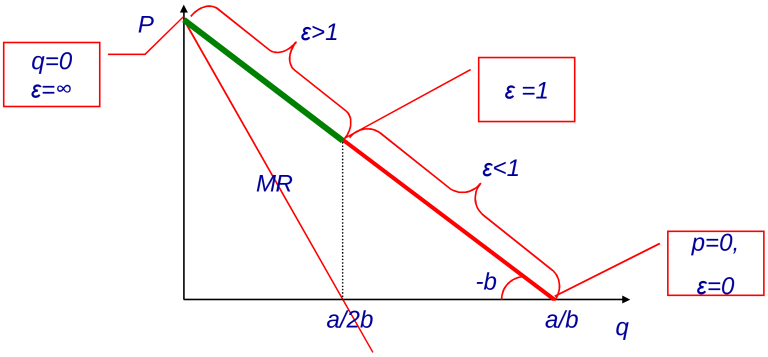
Note if q=0 ⇒ ε=∞

if p=0 ⇒ ε=0

if q=a/2b ⇒ ε=1

2.1 Monopoly (the standard model)

Linear demand example (cont.):



Note that when ε<1 marginal revenue is <0

2.1 Monopoly (the standard model)

If costs are also linear.

$$c(q) = c \times q$$

The monopolist problem is:

$$\underset{q}{Max} \prod = p(q)q - C(q) = (a - bq)q - cq$$

$$\text{FOC: } -bq + a - bq = c \Leftrightarrow a - 2bq = c$$

$$\Leftrightarrow q^M = \frac{a-c}{2b} > 0 \text{ only if } a > c$$

$$p^M = a - b\frac{a-c}{2b} = \frac{a+c}{2} > c \text{ (since } a > c)$$

a represents the willingness to pay for the first unit

2.1 Monopoly (the standard model)

Since $p^M = \frac{a+c}{2}$ and $q^M = \frac{a-c}{2b}$

$$\prod^M = \left(p^M - c\right) q^M = \frac{1}{b}\left(\frac{a-c}{2}\right)^2$$

$$L^M = \frac{p^M - c}{p^M} = \frac{\left(\frac{a-c}{2}\right)}{\left(\frac{a+c}{2}\right)} = \frac{a-c}{a+c} > 0 \text{ i.e. } p^M > c \text{ there is market power}$$

Note: $\uparrow c \Rightarrow \uparrow p^M, \downarrow q^M, \downarrow \pi^M, \downarrow L^M$ (the consumer price does not increase by as much as the costs when the producer is a monopolist)

An increase in the willingness to pay for the first unit (paralell shift in the demand function) $\uparrow a: \Rightarrow \uparrow p^M, \uparrow q^M, \uparrow \pi^M, \uparrow L^M$

2.1 Monopoly (the standard model)

A Comparison between the monopolist case and perfect competition.

Perfect competition. Assumptions:

1. Large number of firms, each with a small market share ⇒ price-taking behavior.
2. Homogenous Products ⇒ consumer always buys from the cheapest provider in the market
3. Free entry and exit

2.1 Monopoly (the standard model)

The Perfect Competition Equilibrium:

1. Price = Marginal Cost (p^c = MC)
2. Zero Profits π^c=0
3. Efficiency (Maximizes total welfare = Consumer Surplus + Producer Surplus (profit =0))

Note: In perfect competition Marginal Revenue equals price since no producer can affect prices by producing more or less (MR=p+qdp/dq=p). Therefore, the optimality condition is always MR=MC (producing any less would lead to MR>MC which would be suboptimal since profits would increase if production increases. The opposite would be true if MR<MC).

2.1 Monopoly (the standard model)

Comparing Monopoly and Perfect Competition:

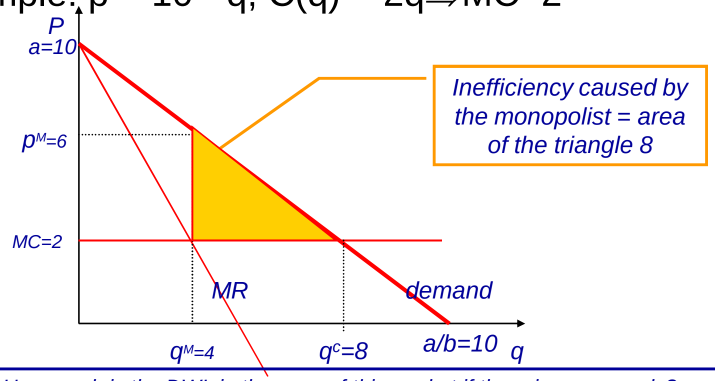
1. $p^M > p^c = c \Rightarrow CS^M < CS^c$
2. $\Pi^M > \Pi^c = 0 \Rightarrow PS^M > PS^c = 0$
3. Monopoly is inefficient. There is a Deadweight Loss (DWL) i.e. a loss of Total Surplus:

$$DWL = TS^c - TS^M > 0$$

4. There are consumers with a valuation for the good that is higher than MC (although lower than p^M) and yet are unable to buy it.

2.1 Monopoly (the standard model)

Example: $p = 10 - q$; $C(q) = 2q \Rightarrow MC=2$



How much is the DWL in the case of this market if there is a monopoly?

$P^c=MC=2$, $q^c=8$; Under Monopoly: $MR=MC \leftrightarrow 10-2q=2 \leftrightarrow q^M=4$; $p^M=10-4=6$

$DWL = 1/2 \times (q^c - q^M) \times (p^M - c) = 1/2 \times (8-4) \times (6-2) = 8$