MICROECONOMICS II

Topic 8 - Monopoly

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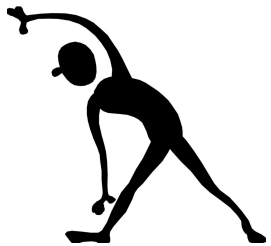
Profit maximization

Problem: $max\Pi(y) = max(r(y) - c(y)) = max(p(y)y - c(y))$

- First-order condition: $MR(y) = MC(y)$
  - Pure competition: $p = MR(y) = MC(y)$
- Second-order condition: $\frac{d^2\Pi(y)}{dy^2} = \frac{dMR(y)}{dy} - \frac{dMC(y)}{y} < 0$
  - In optimum, MC curve has higher slope than MR curve.

Profit maximization



Exercise

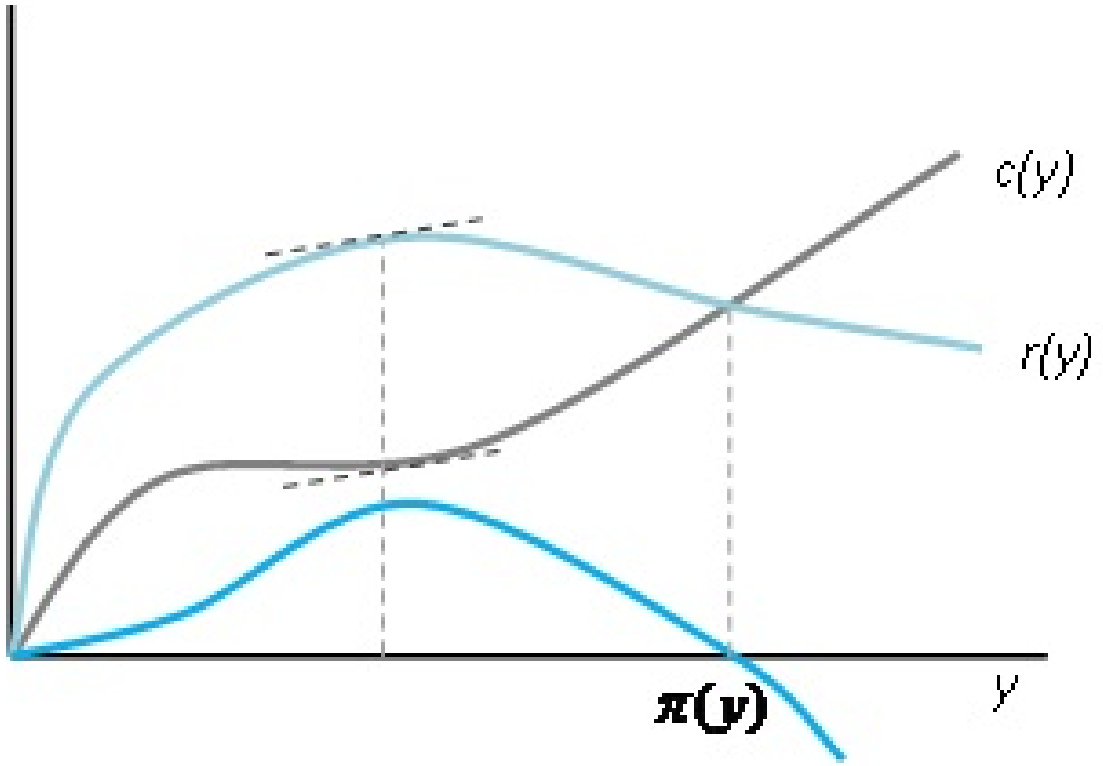
Market demand: $D(p) = 20 - \frac{p}{4}$.

Total cost: $c(y) = 16y + 200$.

- What is the optimal output?
- What price will be charged by the monopoly.
- What will the profit?

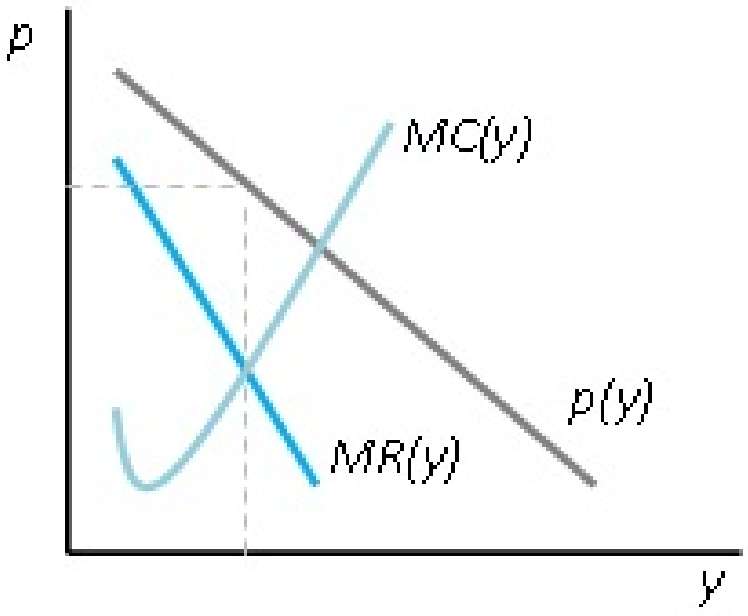
Profit maximization

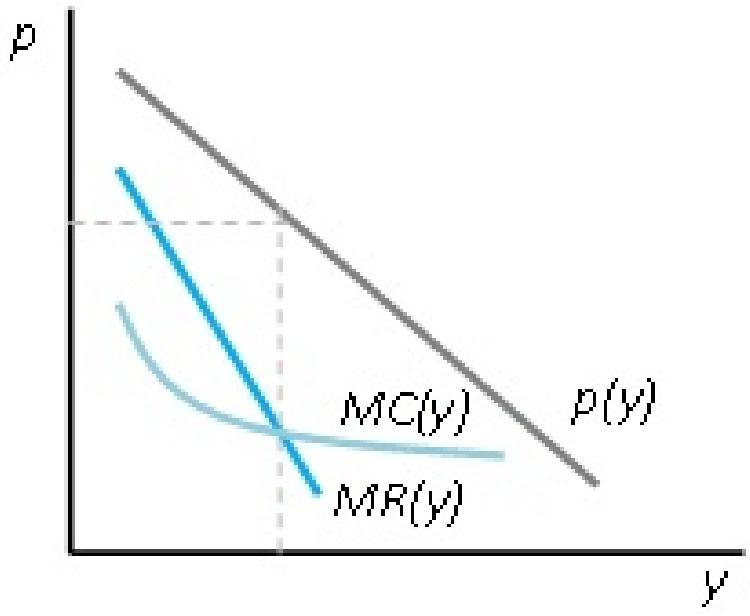
Graphical solution



Profit maximization

$$\frac{dMR(y)}{dy} < \frac{dMC(y)}{dy}$$





Marginal revenue

Higher price $\rightarrow$ lower quantity. Revenue may increase or decrease. Importance of elasticity of the demand.

$$R' - R = \Delta R = (p + \Delta p)(q + \Delta q) - pq = p \Delta q + \Delta pq + \Delta p \Delta q \approx p \Delta q + \Delta pq$$

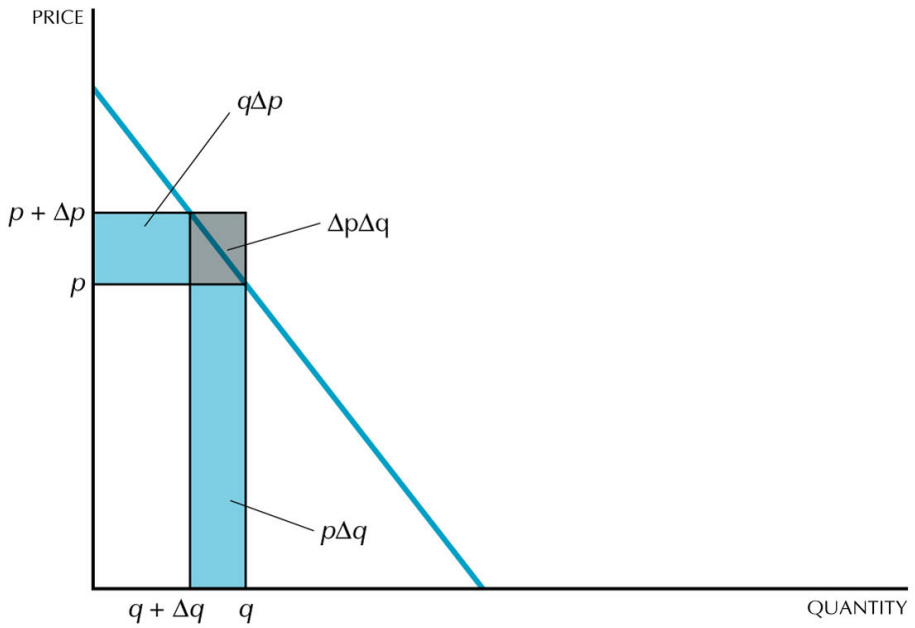
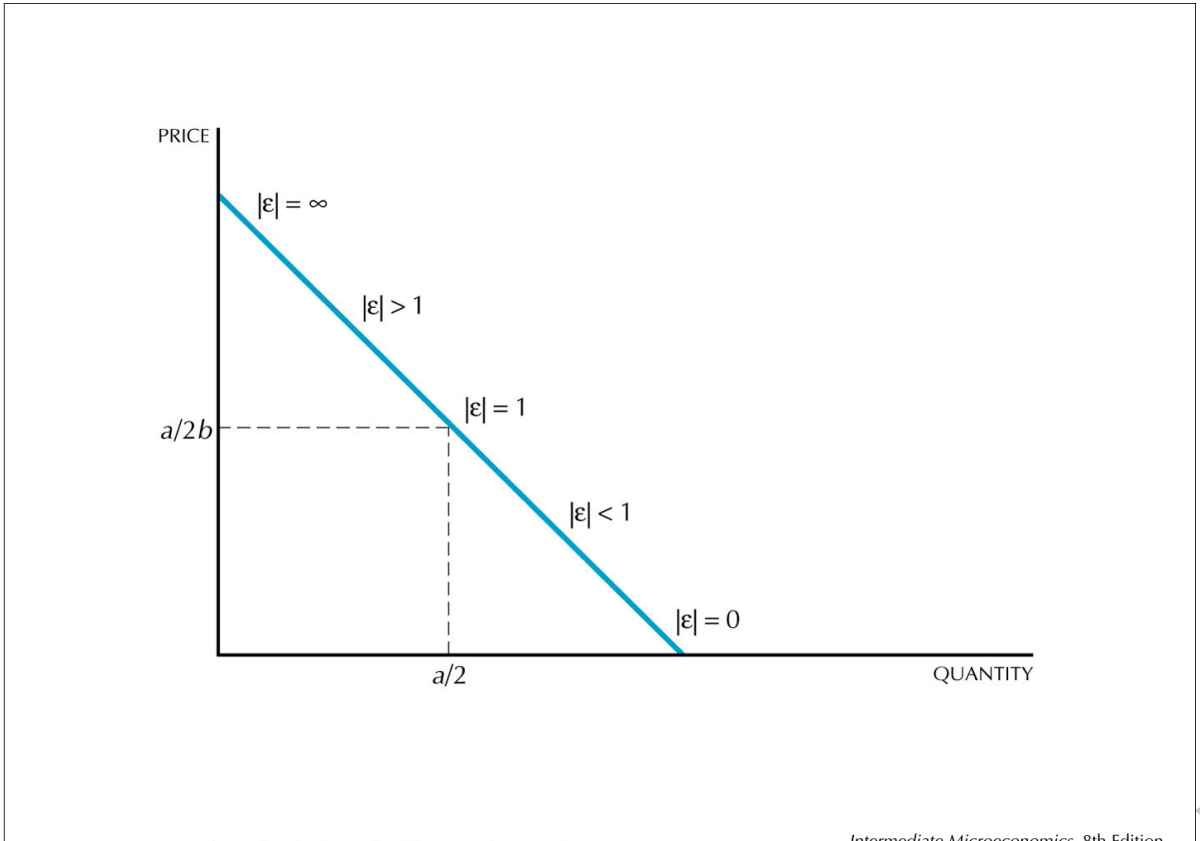


FIGURE 15.5 How revenue changes when price changes

Marginal revenue

Change in revenue with price change

- $\frac{\Delta R}{\Delta p} = q + p\frac{\Delta q}{\Delta p}$
- Positive if $\frac{p}{q}\frac{\Delta q}{\Delta p} > -1$, i.e. $|e(p)| < 1$
- Higher price: revenue increases if the demand is inelastic and decreases if the demand is elastic.



MARGINAL REVENUE

Demand with constant elasticity

- Revenue stays the same if the elasticity is -1.
- Constant elasticity -1: $q = \frac{\bar{R}}{p}$
- In general $q = Ap^e$; $lnq = lnA + elnp$

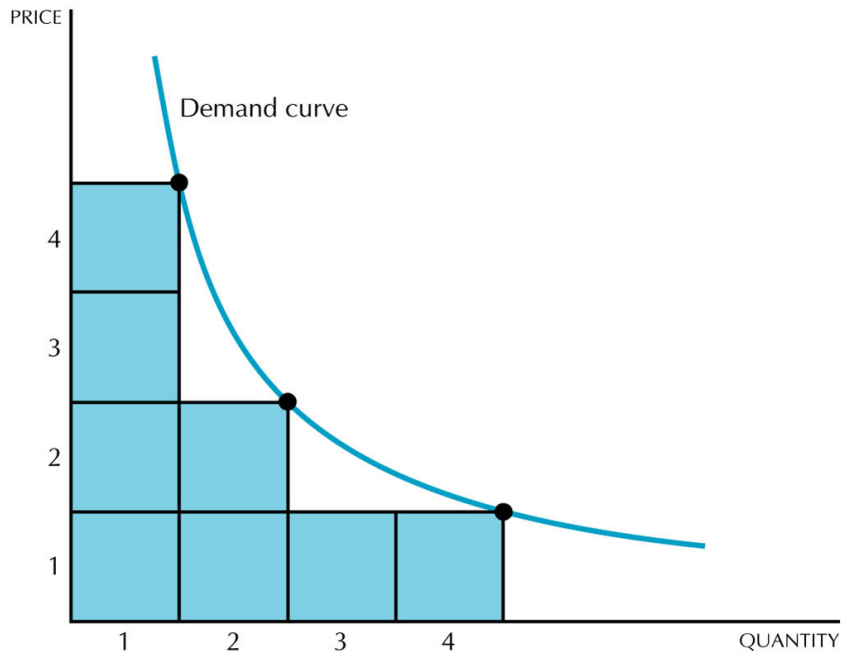


FIGURE 15.6 Unit elastic demand

Marginal revenue

Change in revenue with output change

- $\triangle R = p \triangle q + \triangle pq$
- $MR = \frac{\triangle R}{\triangle q} = p + q\frac{\triangle p}{\triangle q} = p(1 + \frac{q}{p}\frac{\triangle p}{\triangle q})$
- $MR = p(q)(1 + \frac{1}{e(q)}) = p(q)(1 - \frac{1}{|e(q)|})$
  - Higher output: revenue increases if the demand is elastic and decreases if the demand is inelastic.
  - Elasticity -1: $MR = 0$
  - Consistent with the analysis of price change.

Maximizing profit: not at an inelastic part of the demand curve.

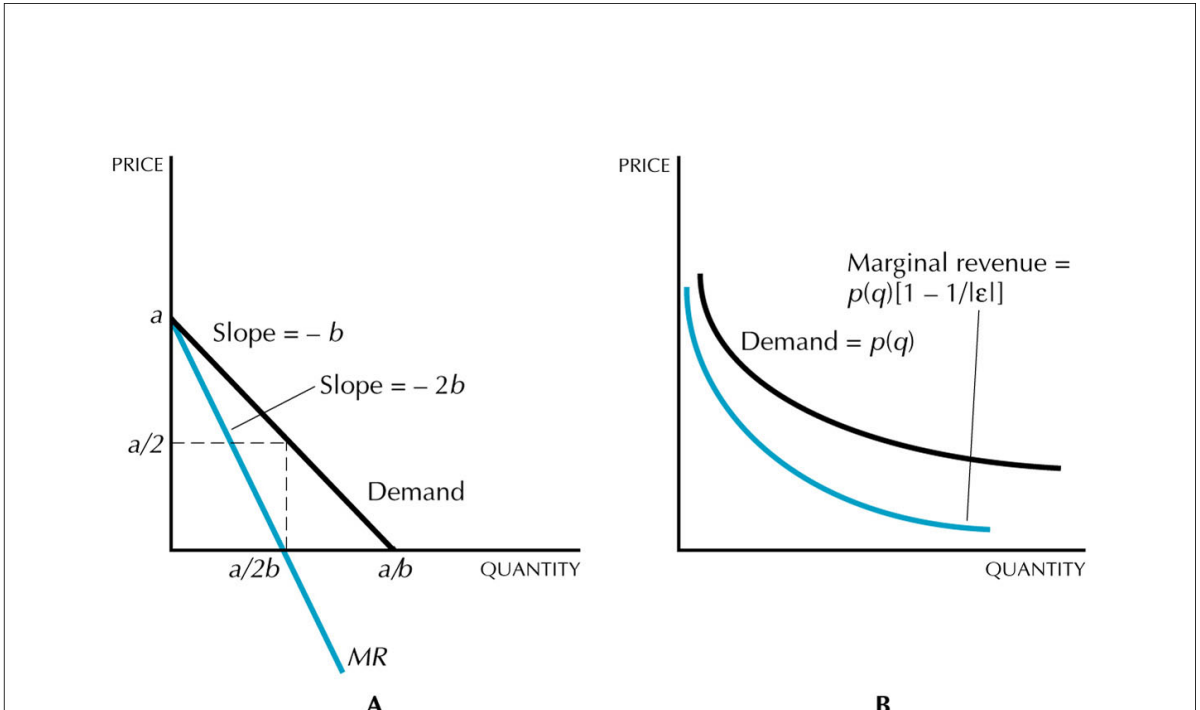
Marginal revenue

MR curve: linear demand curve

- $p(q) = a - bq$
- $TR(q) = p(q)q = aq - bq^2$
- $MR(q) = a - 2bq$

MR curve: constant elasticity demand curve

- $MR = p(q)(1 - \frac{1}{|e|})$
- Constant fraction of the inverse demand curve.

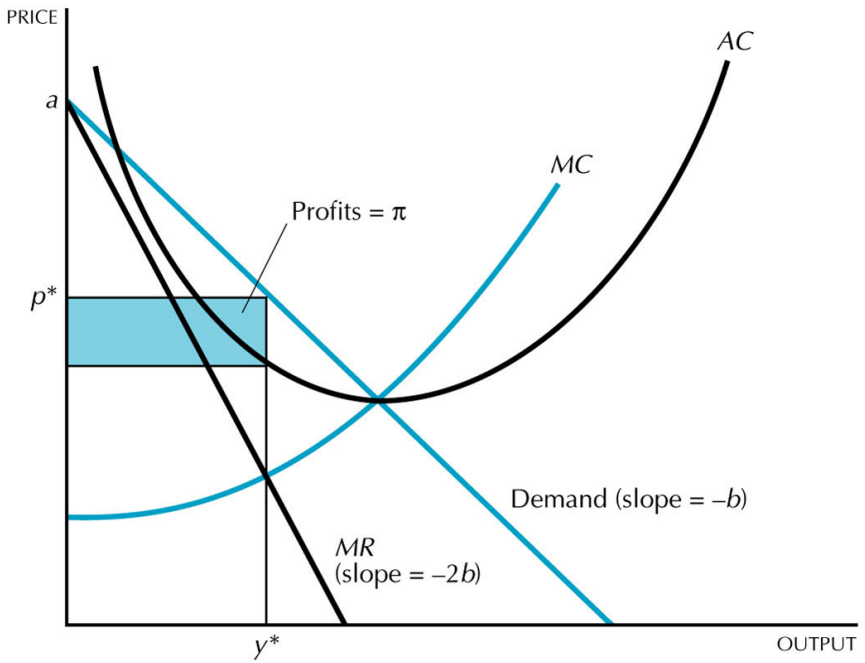


PROFIT

Monopolist faces market demand:

$$MR(y) = p(y)(1 - \frac{1}{|e(y)|}) = MC(y)$$

- Optimal output: $MR = MC$
- Price: the highest possible at optimal output.
- Profit: output multiplied by the difference between price and average cost .

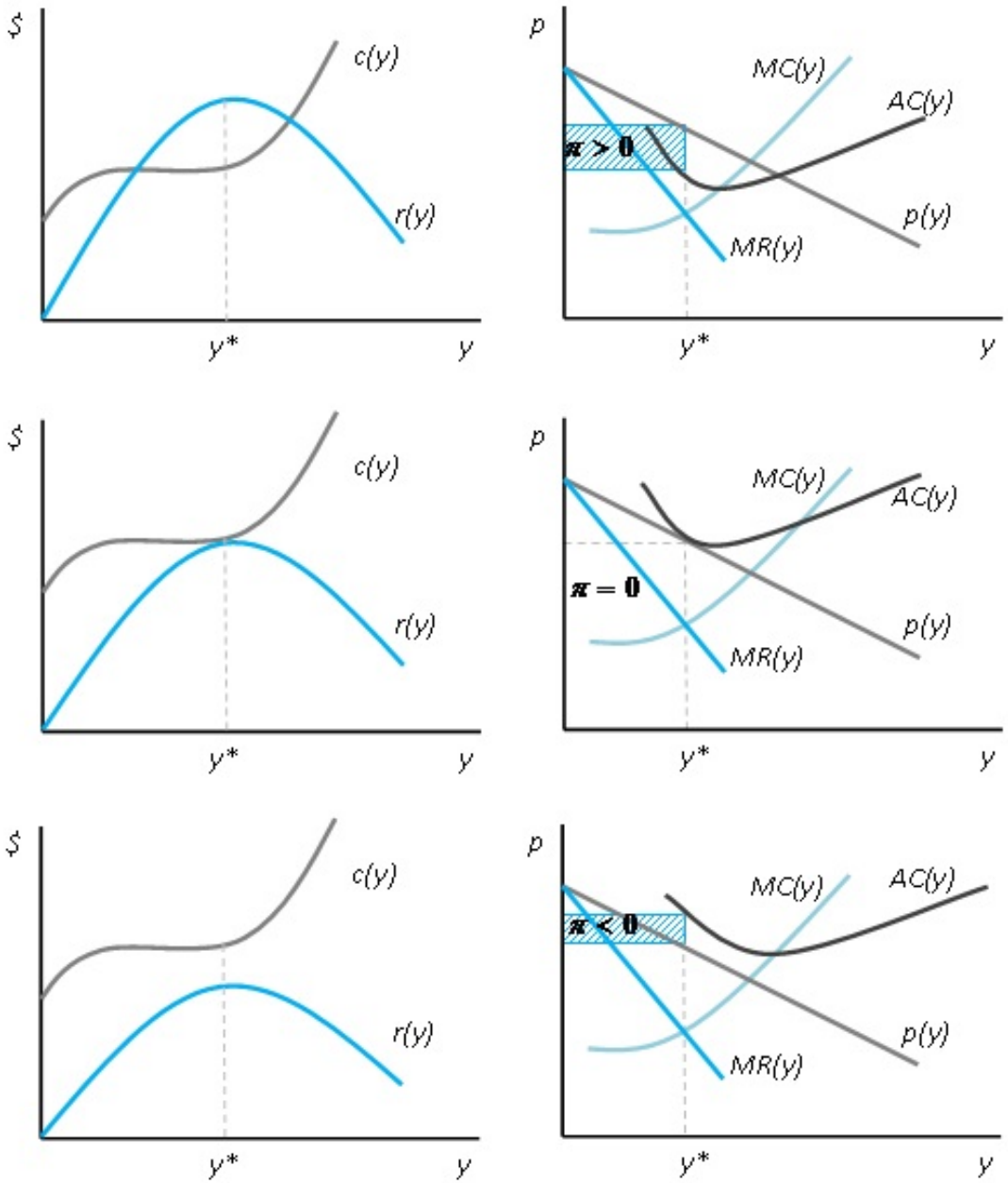


Profit

Typically assumed that monopoly has high profits. But can be zero or negative.

- Profit depends on average cost and average revenue.
- Price above marginal cost, but below average cost $\rightarrow$ negative profit.
- Short-run: firm willing to produce with a loss, if it is not greater than the fixed cost, i.e. price is not below average variable cost.
- Long-run: exit, if no perspective of positive development. Stay, if expected profits are high and it is costly to enter back.

Profit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c(y)
r(y)
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MC(y)
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Markup pricing

The market price is a markup over marginal cost.

- In optimum $p(y) = \dfrac{MC(y)}{1 - \dfrac{1}{|e(y)|}}$
- Markup: $\dfrac{1}{1 - \dfrac{1}{|e(y)|}}$
- Amount of the markup depends on the elasticity.
- Monopolist operates on the elastic part of the demand curve $\rightarrow$ markup greater than 1.
- Pure competition, demand infinitely elastic $\rightarrow$ markup equal to 1.

TAXES

Constant *MC*. Linear demand curve.

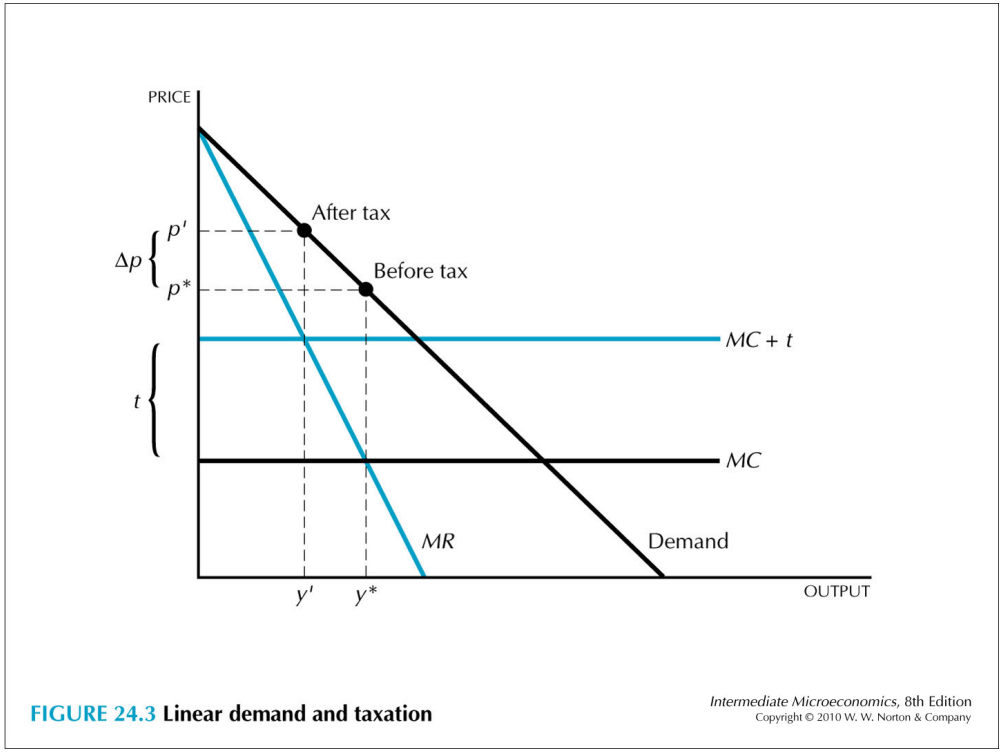

FIGURE 24.3 Linear demand and taxation

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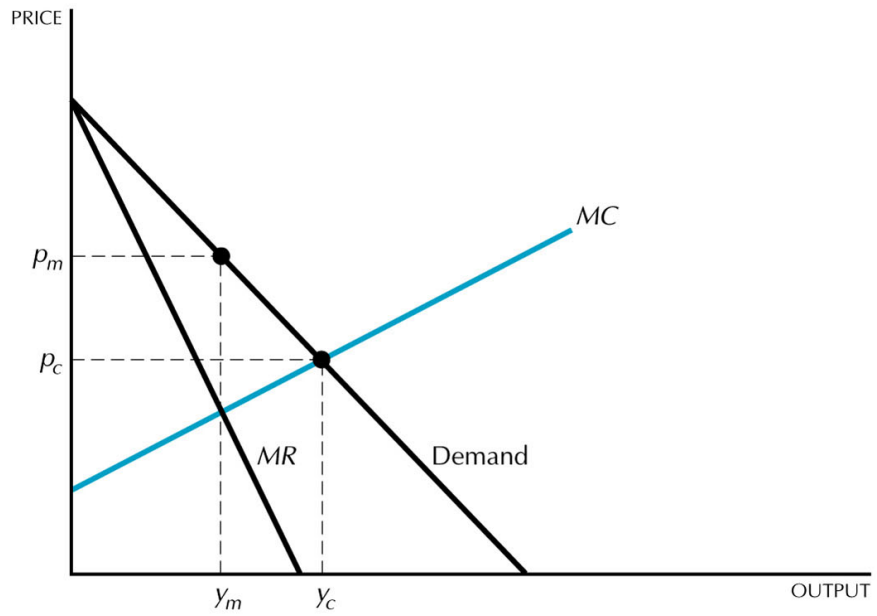
Constant-elasticity demand curve

- More than the amount of the tax passed on by the monopolist.

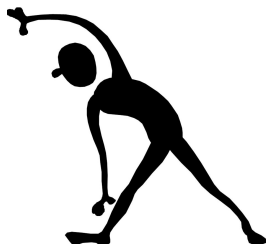
INEFFICIENCY OF MONOPOLY

Comparison to pure competition: higher price and lower output.

- Consumers worse off.
- Firm better off.
- Potential for Pareto improvement. People willing to pay more for additional units that it costs to produce them.



Inefficiency of monopoly



Suppose you are in charge of a toll bridge that is essentially cost-free. The demand for bridge crossings, Q, is given by $P = 12 - 2Q$.

- Draw the demand curve for bridge crossings.
- What is the socially optimal price for crossing the bridge? How many people will cross the bridge at that price?
- If you were a monopolist, what price would you charge?

INEFFICIENCY OF MONOPOLY

Deadweight loss.

- Treat consumers and producer symetrically.
- Change in producer's surplus $(A - C)$
- Change in consumers' surplus $-(A + B)$
- Deadweight loss $-(B + C)$

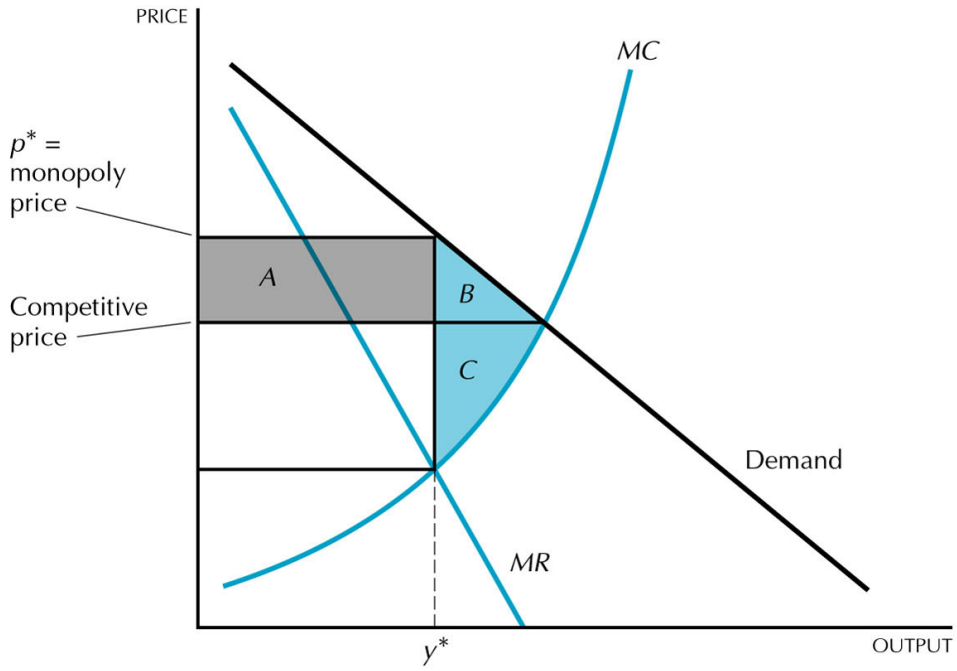


FIGURE 24.5 Deadweight loss of monopoly

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Inefficiency of monopoly

Measuring monopoly market power

- Concentration ratio
  - Share of k largest firms on the total industry output.
  - Problem: same result for an industry with equally large k firms and with one very large firm and $(k-1)$ small ones.
- Herfindahl index: $H = \Sigma S_i^2$, where S_i is the market share of firm i.
  - Zero for pure competition, 10,000 for monopoly.
  - Problem: Producer's behavior may be close to competitive (due to existence of close substitutes, threat of entry)
- Lerner index of monopoly power: $LI = \frac{p - MC(y)}{p} = -\frac{1}{e}$
  - Zero for pure competition.
  - 1 for elasticity equal to -1.

Monopoly market power, application

Market power is not the same as the size of the firm.

Dr. Brown's vs. Coca-Cola

- Dr. Brown's - specialty sodas, celery-flavored soda Cel-Ray.
- Sales of Coca-Cola thousands times larger.
- Elasticity of demand and market power
  - Coca-Cola drinkers price-sensitive, many substitutes, elasticity -4.1. Lerner index $-\frac{1}{e} = 0.244$
  - Cel-Ray drinkers have a unique preference for celery flavor, almost no substitutes, elasticity -2. Lerner index $-\frac{1}{e} = 0.5$
- Dr. Brown's has bigger market power and charges higher markup over its marginal cost.

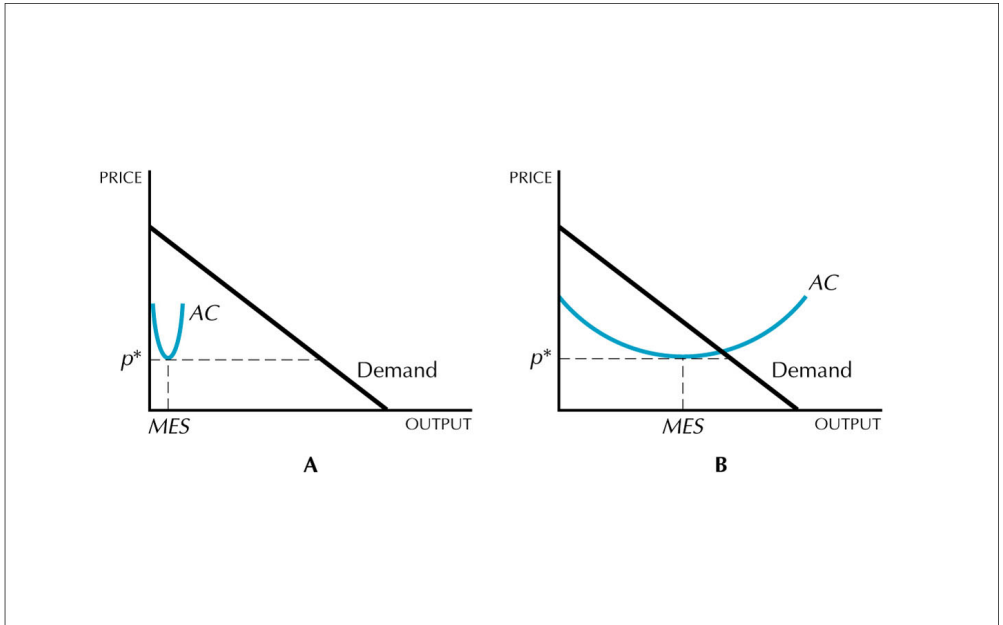
WHAT CAUSES MONOPOLIES?

Control of important inputs

- No close substitutes, entry of others not possible.
- Example: mineral water stream.

Economies of scale (natural monopoly)

- Decreasing *AC* at output levels important relative to the market demand.
- Production by one firm is the least costly.
- *AC* curve determined by technology. Size of the market can be affected by foreign trade policies.



What causes monopolies?

Patents

- Exclusive right to benefit from invention. Encourages innovation.

Government licenses

- Insufficiently defined property rights to a limited input.
- Sensitive industries (e.g. weapons, railways, education).
- Government owns important and limited input (e.g. forests).

Cartel

- Collusion in order to restrict output and sell for higher price. Illegal.
- Unstable due to incentives to break the rules.

High costs of entry

- The incumbent may convince potential entrants it would cut prices if they try to enter.
- Large costs of entry (e.g. loyalty of customers).

What causes monopolies?, application

Controlling a key input.

In 1800s, all rubber from trees in Brazil.

- Trees could not be planted close together because of the leaf-blight fungus which would easily spread.

In 1876, 70 thousand rubber seed stolen by the British.

- Concentrated plantations in Malaysia, no fungus there.
- Dramatic reduction of the cost of harvesting rubber.
- Cost advantage to the British - in early 1900s the plantations were meeting 95% of world's demand for rubber.

In 1927, Henry Ford needed rubber for car tires.

- Rubber plantation in the Amazon, called Fordlandia.
- Because of the fungus, the plantation failed.

Britain's market power survived until the development of synthetic rubber.

REGULATION OF NATURAL MONOPOLY

Price equal to marginal cost.

- Monopoly may make negative profit.
- Example: public utilities (electricity, gas, water) whit large fixed costs and small marginal costs.

Intersection of the average costs and market demand.

- Monopoly does not make loss.
- The service provided to all who want to pay for it.

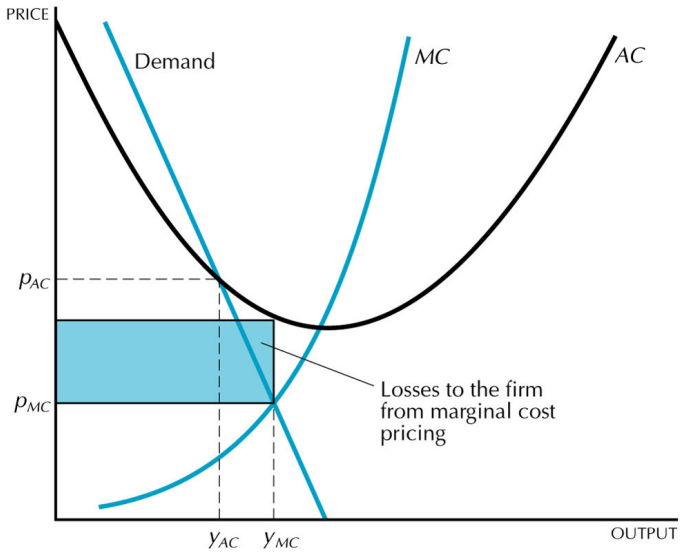


FIGURE 24.6 A natural monopoly

Monopoly vs. pure competition

Price above marginal cost. Monopoly charges higher price and produces lower output.

Production not at the cost minimum.

Production at the elastic part of the demand curve.

Monopoly does not have supply curve. Quantity derived from the market demand.