Overview: Market Power

- Competitive Equilibrium
- Profit Maximization
- Monopoly
  - Output and Price Analytics
- Coordination of Multiple Plants
- Pricing with Learning Effects and Network Externalities

Competitive Equilibrium

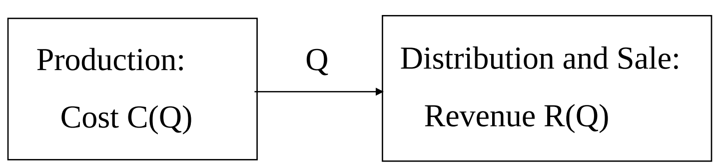
- Mechanism of Competitive Equilibrium
  - Demand Growth
    - Higher prices stimulate more supply from existing firms
    - Emergence of profits causes entry/expansion of capacity
  - Demand shortfall
    - Lower prices cause cutbacks in in supply from existing firms
    - Losses (negative profits) cause exit/contraction of capacity
  - Processes continue until economic profits return to 0

Market Power

- Ability to raise price above costs and make sustainable profits
  - *Economic* costs and *economic* profits

- Requires that the mechanism of competition fails to operate
  - Barriers to entry
  - Sufficient product differentiation (that cannot be copied)
  - Secret technology - No information on profitability
  - Market too small relative to efficient production scale

Profit Maximization



How do you maximize profit

$$\Pi = R - C \ ?$$

(drum roll)

Pick Q such that MR = MC

Monopoly: Price and Output Analytics

- Focus on monopoly, the simplest case of market power
- Suppose we have

Demand: $Q = 100 - P$

Costs: $MC = AC = 10$

Direct Monopoly Solution

Demand: $Q = 100 – P$ implies that

Revenue: $R = PQ = (100 - Q) Q$

$MC = AC = 10$ implies that costs are $C = 10 Q$

Profit: $\Pi = R - C$

$= (100 - Q) Q - 10 Q$

$= (100Q - Q^2) - 10Q$

Want to find Q (or P) that maximizes Π.

Direct Monopoly Solution

Profit: $\Pi = (100Q - Q^2) - 10Q$

Take derivative:

$$d\Pi/dQ = (100 - 2Q) - 10$$

$$(= MR - MC)$$

Profits are maximized where $d\Pi/dQ = 0$

$$0 = (100 - 2Q) - 10 \quad (= MR - MC)$$

$$Q = 45$$

With price

$$P = 100 - Q = 55$$

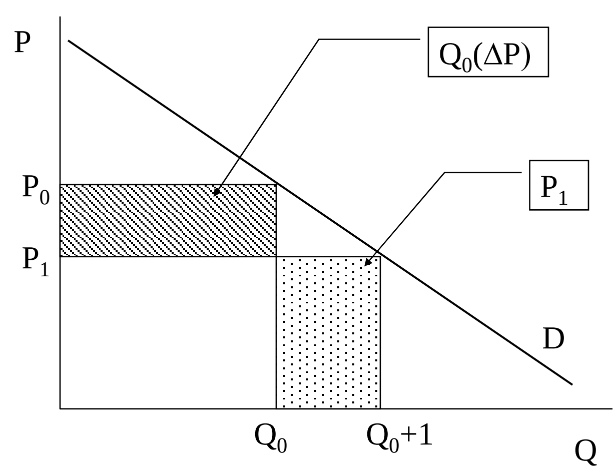
MR in Detail

Approximate MR as ΔR from selling one more unit

i.e., compare selling Q_0 at P_0 with selling $Q_1 = (Q_0+1)$ at P_1 [with $P_1 \leq P_0$]

$$MR = R_1 - R_0 = P_1Q_1 - P_0Q_0$$
$$= P_1(Q_1 - Q_0) + Q_0(P_1 - P_0)$$
$$= P_1 + Q_0\,\Delta P$$

MR in Pictures



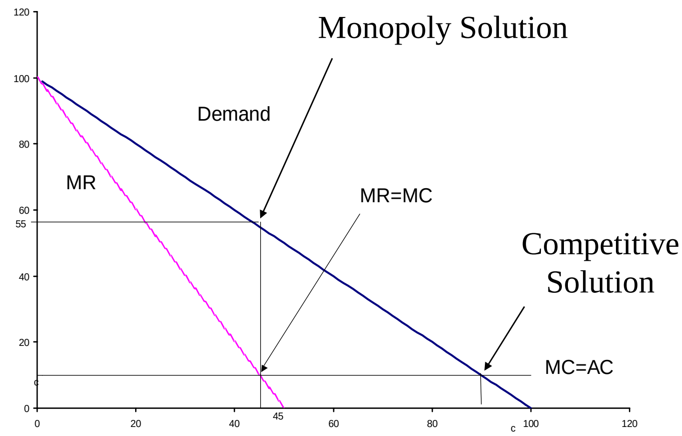
MR, Calculus Version

$$R = P(Q)Q$$

$$MR = \frac{dR}{dQ} = P + Q\frac{dP}{dQ}$$

(Compare to $MR = P_1 + Q_0 \Delta P$)

The Monopoly Picture



The Mark-Up Formula

$$MR = P + Q\frac{dP}{dQ} = P\left(1 + \frac{Q}{P}\frac{dP}{dQ}\right) = P\left(1 + \frac{1}{\varepsilon}\right)$$

At a maximum of profits, we have MR = MC, so

$$MC = P\left(1 + \frac{1}{\varepsilon}\right)$$

Or, rearranging terms,

$$\frac{P - MC}{P} = -\frac{1}{\varepsilon}$$

ε is the price elasticity of demand

Example: Supermarkets and Convenience Stores

- Supermarkets: $\varepsilon \approx -10$
  (P-MC)/P = .1, 10% markup
- Small convenience stores: $\varepsilon \approx -5$
  (P-MC)/P = .2, 20% markup

- Which do you expect to show higher profits?

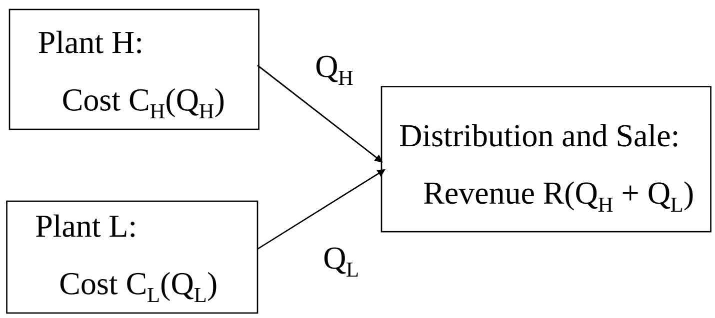
Example: Drug pricing

- Elasticity estimates often are near -1.0

- If elasticity is -1.1, then
  (P –MC)/P = .9; 90% markup

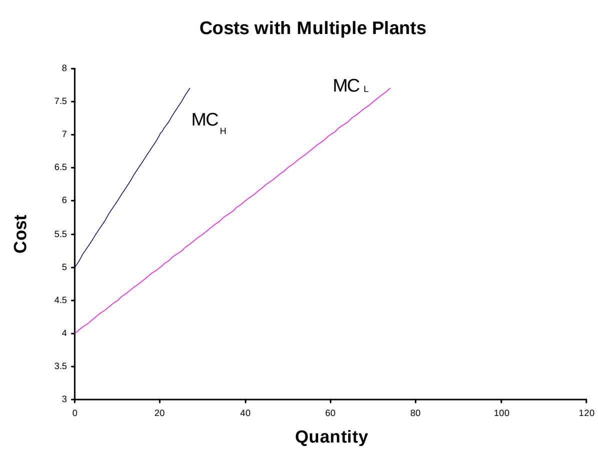
- e.g. Tagamet monopoly, elasticity is -1.7
  (P-MC)/P = .58; 58% markup

Multi-plant Firms

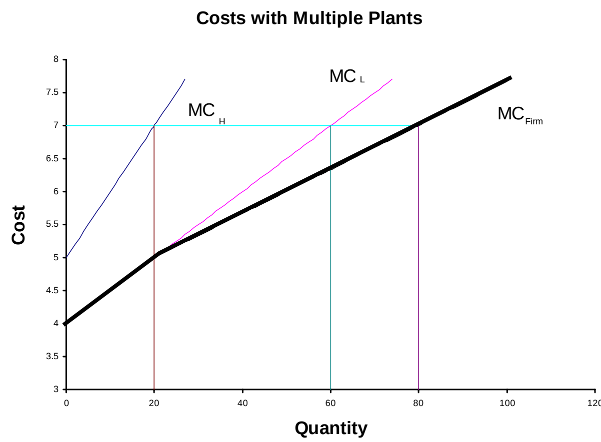


- Max profit $\Pi = R(Q_H + Q_L) - C_H(Q_H) - C_L(Q_L)$, by
- $MC_H(Q_H) = MC_L(Q_L) = MR(Q_H + Q_L)$

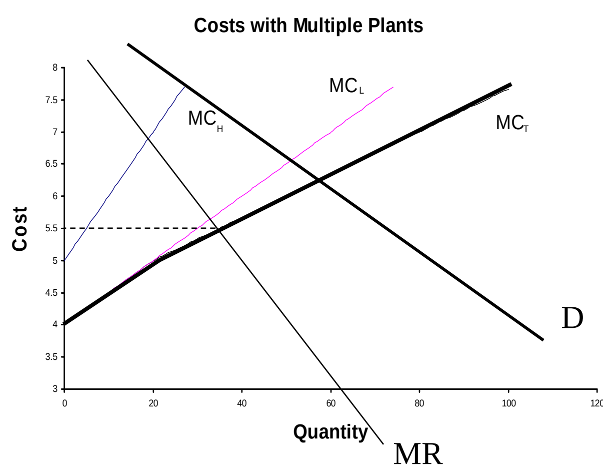
Multi-Plant Firm: Graphical Setup



Overall MC Curve is the *Horizontal* Sum of Individual Plant MC Curves



Pricing and Allocation of Production in a Multi-Plant Firm



Algebra of Constructing MC Curve

Plant "H": $MC_H = 5 + Q/10$

Plant "L": $MC_L = 4 + Q/20$

- Up to Q=20, all production is at "L" and the cost curve is equal to the single plant supply curve (since $MC_L(20) = MC_H(0) = 5$)
- Above Q=20, some production occurs at "H"

Algebra of Overall MC

- To sum horizontally, must solve for Q to add
  - $Q_H = -50 + 10\ MC$
  - $Q_L = -80 + 20\ MC$
- So for $Q_T < 20$
  - $Q_T = Q_L = -80 + 20\ MC$ or
  - $MC = 4 + Q_T /20$
- And for $Q_T > 20$, $Q_T = Q_L + Q_H$
  - $Q_T = -130 + 30\ MC$ or
  - $MC = 13/3 + Q_T/30$

Adjustments to Current MR and MC

- When current production has future implications, the overall profit-maximizing output is typically not given by (current period) $MC_0 = MR_0$
- Learning: Additional production Q_0 gives MR_0 *plus* lower future costs C_1.
- Network Externalities: Additional production Q_0 gives MR_0 *plus* larger future revenue R_1.
- Produce more and lower price. How much depends on size of learning/network effects.

Take Away Points

- Nearly any firm has some degree of market power
- MR = MC;   MR = MC;   MR = MC

  (say 100 times)
- MR = MC has a number of implications
  - The mark-up formula summarizes optimal pricing
  - With multiplant firms, $MR = MC_H = MC_L$