ECO 352 – Spring 2010
Precepts Week 7 – March 22

REVIEW OF MICROECONOMICS : IMPERFECT COMPETITION AND EXTERNALITIES

MONOPOLY

Marginal Revenue

Inverse demand curve P = P(Q) as given
Total revenue R(Q) = Q P(Q)
Marginal revenue MR = dR/dQ = 1 × P + Q × dP/dQ = AR + Q dP/dQ < AR (because dP/dQ < 0)

Examples : [1] Linear demand curve. P = a - b Q , R = a Q - b Q^2 , MR = a - 2 b Q
[2] Iso-elastic demand curve, e is numerical value of price elasticity of demand

$$Q = a\ P^{-e}, \quad AR = P = b\ Q^{-1/e}, \quad R = b\ Q^{(1-1/e)}, \quad MR = b\left(1-\frac{1}{e}\right)Q^{-1/e} = \left(1-\frac{1}{e}\right)AR$$

where b = $a^{1/e}$. If e < 1, MR < 0; then revenue can be increased by reducing output
So obviously monopolist will exploit all such opportunities and operate in region e > 1

Profit Maximization by Choosing Quantity (Or Uniform Price)

Profit π = R – C . First-order condition dπ/dQ = dR/dQ – dC/dQ = MR – MC = 0
Second-order condition $d^2\pi/dQ^2 = d^2R/dQ^2 - d^2C/dQ^2$ = d(MR)/dQ – d(MC)/dQ < 0 ,
so MR should cut MC from above. OK if MC itself is declining: some increasing returns OK.

Examples

1. Linear demand and marginal cost

    $P = AR = a - b\,Q$, $MR = a - 2\,b\,Q$; $MC = c + k\,Q$

    $MR = MC$ implies $Q = (a-c)/(2b+k)$

    Second-order condition: $-2b - k < 0$; $2b+k > 0$

    so k itself can be negative

  Numbers to be used in class later this week:

  $b = 1$, $k = 0$

  $a = 200$, $c = 100$: $Q = 50$, $P = 150$

    Cons. surplus = ½ (200-150) 50 = 1250

  $a = 200$, $c = 120$: $Q = 40$, $P = 160$

2. Iso-elastic demand, constant marginal cost

    $MR = P\,[\,1 - (1/e)] = P\,(e-1)/e$, $MC = c$

    $MR = MC$ implies $P = MC\,e\,/\,(e-1)$ [need $e > 1$]

  This is the rule-of-thumb of monopoly pricing

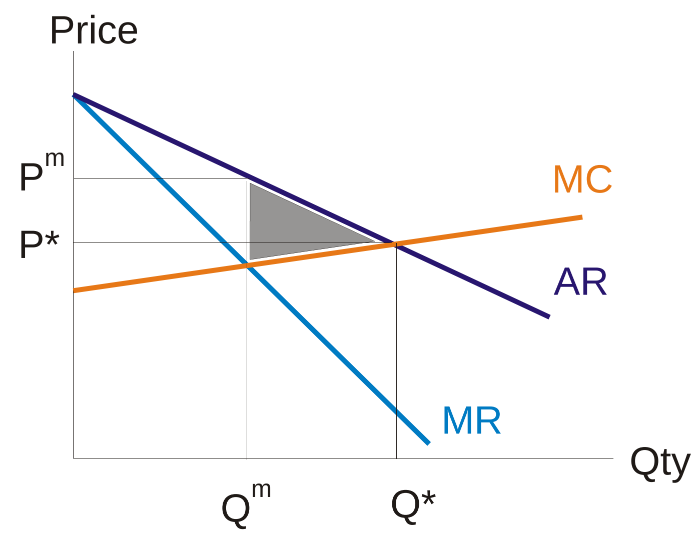
  Write it as $(P-MC)/P = 1/e$: price markup

    or "Lerner Index of monopoly power"

Contrast this with perfect competition.

Monopolist keeps Q below the quantity that
  equates P and MC

This generates dead-weight loss :
  loss of consumer surplus > monopolist's profit



Legend for Figure above

  * = optimum

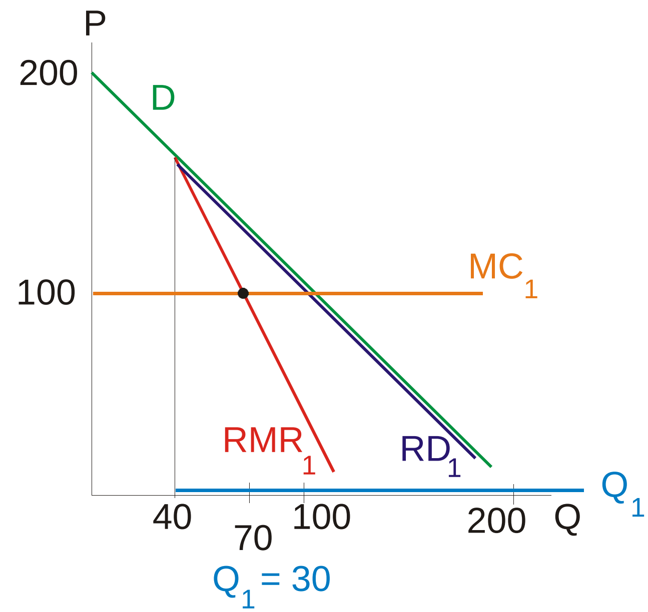
  m = monopolist's choice

  DWL in gray

Exercise - relate DWL to
  CS and PS changes

OLIGOPOLY

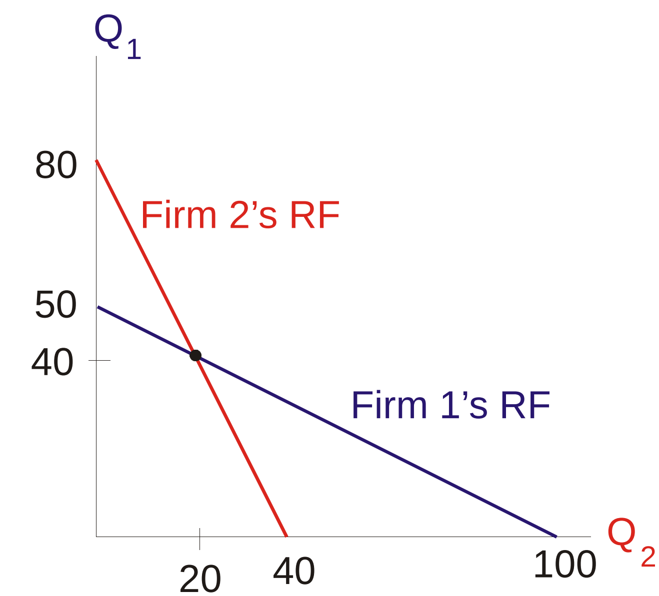
Homogeneous product Cournot duopoly
Industry (inverse) demand: $P = 200 - Q$
Firms' outputs Q_1 , Q_2 . $MC_1 = 100$, $MC_2 = 120$
Each chooses its output, taking the other's output
as given; this is the Cournot-Nash assumption



Suppose $Q_2 = 40$. Firm 1 sees itself facing
residual demand curve $P = 200 - 40 - Q_1$
residual marg. revenue curve $RMR_1 = 160 - 2 Q_1$
Setting this equal to $MC_1 = 100$ yields $Q_1 = 30$;
this is firm 1's best response when firm 2 produces 40.

Algebra: When firm 2 produces Q_2 , firm 1's residual

$RMR_1 = (200 - Q_2) - 2 Q_1$. Setting it $= MC_1 = 100$,
best response function $Q_1 = 50 - (1/2) Q_2$



For firm 2, residual $RMR_2 = MC_2$ equation is
$(200 - Q_1) - 2 Q_2 = 120$; solve to get
best response function $Q_2 = 40 - (1/2) Q_1$

Cournot-Nash equilibrium: mutual best responses
solve the two equations jointly:
$Q_1 = 40$, $Q_2 = 20$; $Q = 60$, $P = 140$.

$Profit_1 = (140-100)\ 40 = 1600$, $Profit_2 = (140-120)\ 20 = 400$. Cons. surp. $= ½\ (200- 140)\ 60 = 1800$

EXTERNAL ECONOMIES

Example: Industry with 1000 firms. Industry inverse demand $P = 180 - 0.007\,Q$

Each firm's output denoted by q . Firm's $TC = (\,120 - 0.002\,Q\,)\,q + 0.5\,q^2$

Thus higher industry output shifts down each firm's cost curves: this is external economy

Possible reasons: An industry-wide input produced with economies of scale,
or industry-wide know-how spreads more easily to individual firms (silicon valley story).

Each firm is small: takes as given the market price P and the industry output Q

Therefore it computes its marginal cost as $MC = 120 - 0.002\,Q + q$

Equilibrium:

Each firm's profit-maximization implies P = MC, so $P = 120 - 0.002\,Q + q$

But $Q = 1000\,q$, so $P = 120 - 0.002\,Q + 0.001\,Q = 120 - 0.001\,Q$

This is "forward-falling industry supply" (see K-O p.143); also $Q = 1000\,(120 - P)$

Demand $P = 180 - 0.007\,Q$, so for equilibrium $180 - 0.007\,Q = 120 - 0.001\,Q$

Equilibrium $Q = 10{,}000$, $q = 10$, $P = 110$

Optimum:

Industry's total cost recognizing $Q = 1000\,q$ is

$ITC = 1000\,[\,(120 - 2\,q\,)\,q + 0.5\,q^2\,] = 1000\,[\,120\,Q / 1000 - 1.5\,(Q/1000)^2\,]$

So industry's $MC = 120 - 0.003\,Q$. Equate this to $P = 180 - 0.007\,Q$ and solve

Optimum $Q = 15{,}000$, $q = 15$, $P = 75$