Homework

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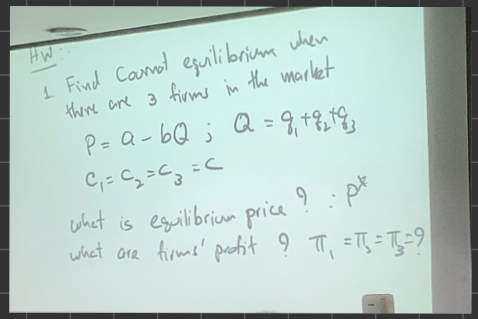


1 $P = a - bQ$; $Q = q_1 + q_2 + q_3$

$c_1 = c_2 = c_3 = c$

What is equilibrium price ? / What are firm's profit ?

$\pi_i = (P - c)q_i = (a - b(q_1 + q_2 + q_3) - c)q_i$

$\max \pi_i = \frac{\partial \pi}{\partial q_i} = 0$; $(a - b(q_1 + q_2 + q_3) - c) + q_1(-b) = 0$

$q_1 = a - c - bq_1 - bq_2 - bq_3 - bq_1$

$0 = a - c - bq_2 - bq_3 - 2bq_1$

$2bq_1 = a - c - bq_2 - bq_3$

BR $q_1^* = \frac{a - c - bq_2 - bq_3}{2b} \rightarrow 1$

$q_2^* = \frac{a - c - bq_1 - bq_3}{2b} \rightarrow 2$

$q_3^* = \frac{a - c - bq_1 - bq_2}{2b} \rightarrow 3$

sub 2 in 1 ;

$q_1^* = \frac{a - c - bq_2 - b\left(\frac{a - c - bq_1 - bq_3}{2b}\right)}{2b}$

$q_1^* = \frac{a - bq_3}{3b}$ $\quad q_2^* = \frac{a - bq_3}{3b}$

sub q_1^* and q_2^* in 3 ;

$q_3^* = \frac{a - c - b\left(\frac{a - bq_3}{3b}\right) - b\left(\frac{a - bq_3}{3b}\right)}{2b}$

$= \frac{a + 2bq_3}{6b}$

$6bq_3 = a + 2bq_3$

$4bq_3 = a$

$q_3 = \frac{a}{4b}$

sub q_3^* ;

$q_1^* = \frac{a - b\left(\frac{a}{4b}\right)}{3b}$

$q_1^* = \frac{a}{4b}$

$q_2^* = \frac{a}{4b}$

$P = a - bQ$

$= a - 3b\left(\frac{a}{4b}\right)$

$= a - \frac{3}{4}a$

$P = 0.25a$ ✓

$\pi_i = (P - c)q_i$

$\pi_1 = (0.25a - c)\frac{a}{4b}$

$\therefore \pi_1 = \frac{a^2}{16b} - c$ ✓

$\pi_2 = \frac{a^2}{16b} - c$ ✓

$\pi_3 = \frac{a^2}{16b} - c$ ✓

2 If there are N firms

$q_i^* = f(N)$, $P = f(N)$, $\pi_i = f(N)$

assume $q_1 + q_2 + q_3 + \dots q_n = A$

$P = a - b(q_1 + q_2 + q_3 + \dots q_n)$

$P = a - bq_1 - bq_2 - \dots bq_n$

$\pi_i = (P - C)q_i$

$\pi_1 = (a - bq_1 - bq_2 - \dots bq_n)q_1 - C_1$

$\frac{\partial \pi_1}{\partial q_1} = 0$; $q_1 = \frac{a}{2b} - 0.5(q_2 + q_3 + \dots q_n)$

$\downarrow$

$q_n = \frac{a}{2b} - 0.5(q_2 + q_3 + \dots q_{n-1})$

$\therefore q_1^* = q_2^* = \dots q_n^* = \frac{a}{b} - A \rightarrow 1$

$A = q_1 + q_2 + \dots q_n$

$A = n(\frac{a}{b} - A)$

$A = nA = n(\frac{a}{b}) \rightarrow A = \frac{na}{(n+1)b}$

$P = a - bA$

$= a - b(\frac{na}{(n+1)b})$

$= a - (\frac{n}{(n+1)})a$

$= \frac{na + a - na}{n+1}$ $P = \frac{a}{n+1}$ ✓

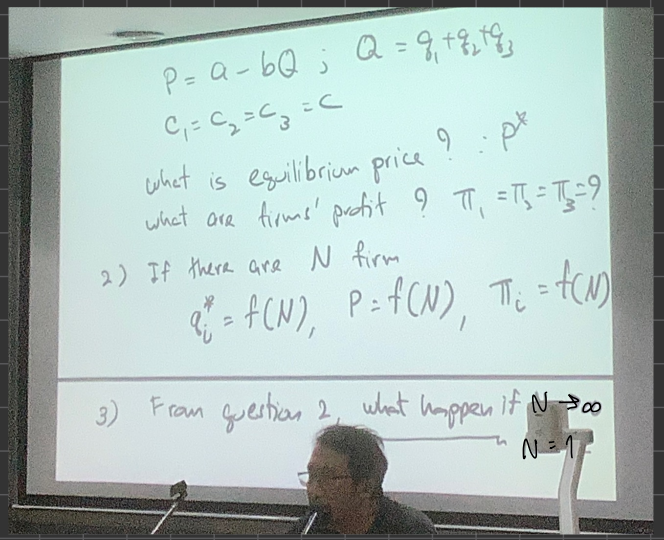
$\pi = p \cdot q_i + C_i$

$= \frac{a}{n+1} \cdot \frac{a}{(n+1)b} - C_i$

$\pi_i = \frac{a^2}{(n+1)^2 b} - C_i$ ✓

sub A into 1 ; $q_1 = \frac{a}{(n+1)b}$

$q_i = \frac{a}{(n+1)b}$ ✓



3 what happan if $N \to \infty$
$N = 1$

normally; If $N \to \infty$, it means that the market Q goes to a competitive level and the price (P*) adulate to marginal cost (MC). The market is perfectly competitive market.

In correct, must be at least 2 or more firms, thus if $n = 1$ firms will be come monopolist,

it $n \to \infty$; $q_i = \frac{a}{(n+1)b}$ will be nearly to 0 and each firm will sell at q nearly to 0 unit

$A = \frac{na}{(n+1)b}$ will be nearly to 0, and sum of ereny firms q will nearly ∞

$\varphi = \frac{a}{n+1}$ will nearly to 0, supply will increase as p decrease to nerly 0

$\Pi_i = \frac{a^2}{(n+1)^2 b} - C_i$ each firms will lose their profit.

it $n = 1$; $q_i = \frac{a}{(n+1)b} = \frac{a}{2b} \to$ since $q = \frac{a}{2b} < q = \frac{na}{(n-1)b}$, monopoly will sell less.

$A = \frac{na}{(n+1)b} = q$, it means firms will be monopolist.

$\varphi = \frac{a}{n+1}$ since $P_m = \frac{a}{2} > P_c = \frac{a}{n+1}$ monopoly will set high price

$\Pi_i = \frac{a^2}{(n+1)^2 b} - C_i = \frac{a^2}{4b} - C_i \to$ since $\Pi_M > \Pi_C$, thus monopolist earn higher Π.