

- ① Suppose the demand curve is $Q(p) = p^\epsilon$, what is the elasticity of demand? If marginal cost is \$1 and $\epsilon = -2$, what is the profit-maximizing price?

$$Q(p) = p^\epsilon$$

$$\frac{dQ}{dp} = \epsilon p^{\epsilon-1}$$

$$\frac{dQ}{dp} \times \frac{p}{Q} = \epsilon p^{\epsilon-1} \left(\frac{p}{p^\epsilon} \right)$$

$$= \epsilon p^{\epsilon-1} (p^{1-\epsilon}) = \epsilon \quad \therefore \text{elasticity of demand} = \epsilon$$

$$TR = Q^{\frac{1}{\epsilon}+1}$$

$$MR = \left(\frac{1}{\epsilon} + 1 \right) Q^{\frac{1}{\epsilon}}$$

$$\text{Max } \pi = MR - MC$$

$$= \left(\frac{1}{\epsilon} + 1 \right) Q^{\frac{1}{\epsilon}} - 1$$

$$= \frac{1}{2} Q^{-\frac{1}{2}} - 1$$

$$1 = \frac{1}{2} Q^{-\frac{1}{2}}$$

$$Q^{-\frac{1}{2}} = 2$$

$$Q = \frac{1}{4}$$

$$\frac{dQ}{dp} \times \frac{p}{Q} = \epsilon \times \frac{Q^{\frac{1}{\epsilon}}}{Q}$$

$$= -2 \left(\frac{\left(\frac{1}{4} \right)^{-\frac{1}{2}}}{\frac{1}{4}} \right) = -2(8) = -16 \quad \therefore p = -16$$

- Suppose the demand curve for corn is $Q(p) = 10 - p$. Suppose that one firm owns all five units of corn in the world and has zero marginal cost. Does a monopoly sell less output than would be sold in a competitive market in which 100 firms each own 0.05 units?

$$Q = 10 - p$$

$$p = 10 - Q$$

$$\begin{aligned} TR &= PQ \\ &= (10 - Q)Q = 10Q - Q^2 \end{aligned}$$

$$\begin{aligned} \frac{\partial TR}{\partial Q} &= 10 - 2Q \\ MR &= 10 - 2Q \end{aligned}$$

$$\begin{aligned} MR &= MC : 10 - 2Q = 0 \\ Q &= 5 \end{aligned}$$

$$\boxed{Q_M = 5}$$

$$Q_C = 100 \times 0.05$$

$$\boxed{Q_C = 5}$$

$\therefore$ No, monopoly and competitive market sell the same amount of output ($Q=5$)

3 8. Output is homogenous and the demand curve is

$$P = 448 - Q.$$

There are two firms with identical costs given by $C = q_i^2$ where q_i is the production of firm i . The marginal cost of firm i is $MC_i(q_i) = 2q_i$.

- Find the Cournot equilibrium firm outputs.
- Find the Stackelberg equilibrium firm outputs.

9) Cournot Equilibrium

$$\begin{aligned} \text{Firm 1: } \pi &= P(q_1, q_2)q_1 - q_1^2 \\ &= (448 - q_1 - q_2)q_1 - q_1^2 \\ &= 448q_1 - q_1^2 - q_1q_2 - q_1^2 \\ &= 448q_1 - 2q_1^2 - q_1q_2 \end{aligned}$$

$$\frac{\partial \pi}{\partial q_1} = 448 - 4q_1 - q_2 = 0$$

$$\boxed{q_1^* = 112 - \frac{1}{4}q_2} \quad q_1 = 112, q_2 = 448$$

$$\begin{aligned} \text{Firm 2: } \pi &= P(q_1, q_2)q_2 - q_2^2 \\ &= (448 - q_1 - q_2)q_2 - q_2^2 \\ &= 448q_2 - q_2^2 - q_1q_2 - q_2^2 \\ &= 448q_2 - 2q_2^2 - q_1q_2 \end{aligned}$$

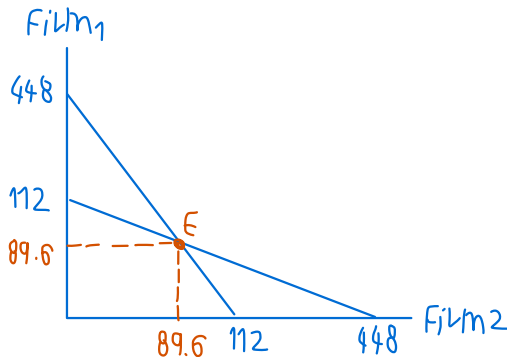
$$\frac{\partial \pi}{\partial q_2} = 448 - 4q_2 - q_1 = 0$$

$$\boxed{q_2^* = 112 - \frac{1}{4}q_1}$$

Find q_1^*, q_2^* :

$$\begin{aligned} q_1^* &= 112 - \frac{1}{4}(112 - \frac{1}{4}q_1) \\ &= 112 - 28 + \frac{1}{16}q_1^* \\ \frac{15}{16}q_1^* &= 84 \\ q_1^* &= 89.6 \end{aligned}$$

$$\begin{aligned} q_2^* &= 112 - \frac{1}{4}(112 - \frac{1}{4}q_2) \\ &= 112 - 28 + \frac{1}{16}q_2^* \\ \frac{15}{16}q_2^* &= 84 \\ q_2^* &= 89.6 \end{aligned}$$



b) Stackelberg Equilibrium

if Firm 1 moves first:

$$\begin{aligned}\text{Firm 2: } \pi &= P(q_1, q_2) q_2 - q_2^2 \\ &= (448 - q_1 - q_2) q_2 - q_2^2 \\ &= 448 q_2 - q_2^2 - q_1 q_2 - q_2^2 \\ &= 448 q_2 - 2 q_2^2 - q_1 q_2\end{aligned}$$

$$\frac{\partial \pi}{\partial q_2} = 448 - 4 q_2 - q_1 = 0$$

$$q_2^* = 112 - \frac{1}{4} q_1$$

$$\begin{aligned}\text{Firm 1: } \pi &= P(q_1, q_2) q_1 - q_1^2 \\ &= (448 - q_1 - 112 + \frac{1}{4} q_1) q_1 - q_1^2 \\ &= (336 - \frac{3}{4} q_1) q_1 - q_1^2 \\ &= 336 q_1 - \frac{3}{4} q_1^2 - q_1^2 \\ &= 336 q_1 - \frac{7}{4} q_1^2\end{aligned}$$

$$\frac{\partial \pi}{\partial q_1} = 336 - \frac{7}{2} q_1 = 0$$

$$q_1^* = 96$$

$$q_2^* = 112 - \frac{1}{4} (96) = 88$$

$$q_2^* = 88$$

- ④ (write about 0.5 page) Find 1 example of an industry that has a dominant firm. Describe what this industry is, which firm is the dominant firm, which firms are fringe firms (name the ones that you

Petroleum industry, or also known as oil industry, is considered as a major industry that plays a crucial role in global economy. This is because oil has an huge impact on many factors in the worldwide level, such as transportation, industrial production, manufacturing, and electricity.

The industry can be divided into three main segments which are upstream, midstream, and downstream.

- Upstream companies find reservoirs and drill an oil.
- Midstream companies transport an oil from the wells to refineries.
- Downstream companies refine an oil and sell the finished products.

In Thailand's petroleum industry,

Dominant firm : PTT

Fringe firms : Esso, Caltex, Shell, PT