

1. Consider a long-run production in which there are only two inputs labor and capital, and the input prices for labor and capital are wage ( $w$ ) and interest rate ( $r$ ), respectively. Suppose that at the equilibrium levels of labor and capital ( $L^*$ ,  $K^*$ ), the marginal product of labor ( $MP_L$ ) and marginal product of capital ( $MP_K$ ) are 6 and 8, respectively.

1.a) Calculate the marginal rate of technical substitution (MRTS), and state the cost-minimization conditions of this firm, given that the required output is fixed at  $Q_0$ . If the market wage rate ( $w$ ) is \$3, what is the interest rate at the equilibrium?

1.b) Suppose now that the wage rate ( $w$ ) increases to \$4, *ceteris paribus*. Draw a diagram to illustrate the changes in the cost-minimizing combination of inputs.

$$1. a) |MRTS_{LK}| = \left| \frac{\Delta K}{\Delta L} \right| = \frac{MP_L}{MP_K} = \frac{6}{8} = \frac{3}{4} \neq$$

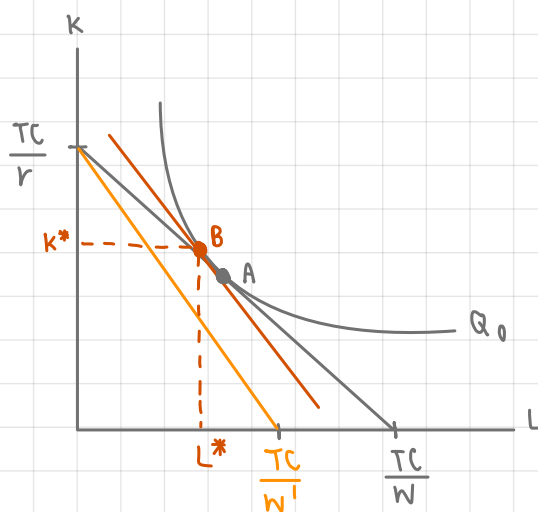
$$\text{cost minimization conditions of this firm} \Rightarrow \frac{MP_L}{P_L} = \frac{MP_K}{P_K}$$

$$\Rightarrow \frac{MP_L}{w} = \frac{MP_K}{r}$$

$$\Rightarrow \frac{6}{3} = \frac{8}{r}$$

$$\Rightarrow r = \frac{24}{8} = 4 \neq$$

1. b)  $w = 3$  and  $w' = 4$ , while  $r$  remains at 4



• new optimal point for minimizing cost is point B (where  $\frac{MP_L}{P_L} = \frac{MP_K}{P_K}$ )

2. Suppose that in the long-run production of wine, a firm uses two inputs: workers ( $L$ ) and machines ( $K$ ). At the required output of 3,000 bottles of wine, the firm's least-cost input combination is 200 units of  $L$  and 50 units of  $K$ , and the per-unit input prices for  $L$  and  $K$  are \$10 and \$20, respectively. Suppose further that at this least-cost combination of inputs, the marginal product of the 50<sup>th</sup> machine ( $MP_K$ ) is 8 bottles of wine.

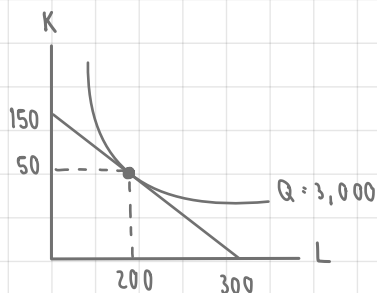
2.a) Draw a diagram to illustrate this firm's cost-minimization decision, where  $L$  is on the x-axis and  $K$  is on the y-axis. Also, explain the firm's cost-minimization conditions.

2.b) At the equilibrium in part a., what is the marginal product ( $MP_L$ ) of the 200<sup>th</sup> workers?

2.b) cost minimization condition (eqbm.)

$$\begin{aligned} \hookrightarrow \frac{MP_K}{P_K} &= \frac{MP_L}{P_L} \\ \frac{8}{20} &= \frac{MP_L}{10} \\ MP_L &= \frac{80}{20} = 4 \quad \# \end{aligned}$$

2.a)



$$\begin{aligned} Q &= 3,000 \\ TC &= Kr + Lw \\ TC &= (50)(20) + (200)(10) \\ TC &= 1000 + 2000 \\ TC &= \$ 3,000 \end{aligned}$$

∴ Firm should decide to choose optimal level of  $K^*$  and  $L^*$  at  $(50, 200)$  to minimize their cost of production.

find  $K \hookrightarrow 3,000 = K(20) + 0$   
when  $L=0$   $K = 150$

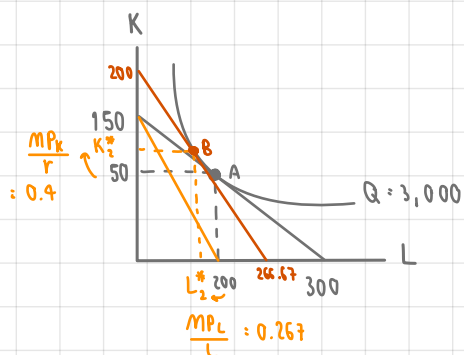
find  $L \hookrightarrow 3,000 = 0 + 10L$   
when  $K=0$   $L = 300$

2.c) Suppose that the input price for  $L$  increases to \$15 per unit, while the input price for  $K$  and the required amount of output are the same. Draw another diagram to illustrate the change in the least-cost input combination.

2.d) Explain the difference between short-run and long-run production.

2.c)  $w$  increases to  $w'$  ( $w' = 15$ ), while  $r$  remains at 20

∴ Firm's eqbm. will move from point A to point B. So, firm should increase amount of capital and hire less labor in order to minimize their cost. In other word, at point B, the production be more capital intensive.



$$\begin{aligned} TC &= Kr + Lw \\ TC &= (50)(20) + (200)(15) \\ TC &= 1000 + 3000 \\ TC &= \$ 4,000 \end{aligned}$$

$$\text{new } K = \frac{TC}{r} = \frac{4,000}{20} = 200$$

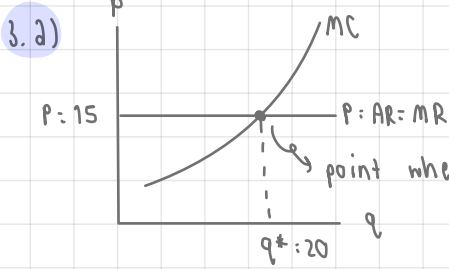
$$\text{new } L = \frac{TC}{w} = \frac{4,000}{15} = 266.67$$

2.d) In the SR production, there will be at least one fixed factor utilized, which usually assumed  $K$  to be fixed factor and  $L$  to be variable factor. So, In SR we get  $(L \Rightarrow q)$ . On the other hand, long-run production occurs when a firm can adjust the amount of all factors of production. So, in LR, we get  $q = f(K, L)$ . Consequently, firm has to select optimal combination for each level of output to minimize firm's cost.

3. Consider a perfectly competitive market, in which the current equilibrium price is 150 baht per unit.

3.a) Suppose that a firm in this market sells 20 units of its output. State the profit-maximizing condition of this firm, and draw a diagram to illustrate how the equilibrium quantity is determined.

3.b) At this equilibrium quantity of 20 units, suppose that the firm's average total cost is 180 baht, and its average fixed cost is 60 baht. Calculate this firm's average variable cost, total revenue, total cost, and profit.



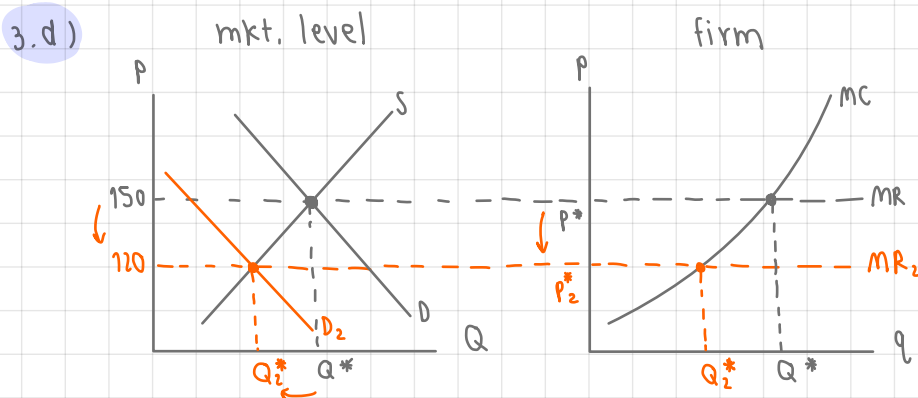
profit maximization condition in perfectly competitive mkt. is when  $MR = MC$

- 3.b) •  $ATC = AVC + AFC$
- $AVC = ATC - AFC$
- $AVC = 180 - 60$
- $AVC = 120 \text{ baht } \#$
- $TR = P \cdot q = 150 \cdot 20 = 3,000 \text{ baht } \#$
- $TC = ATC \cdot q = 180 \cdot 20 = 3,600 \text{ baht } \#$
- $\pi = TR - TC = 3,000 - 3,600 = -600 \#$  ( $\pi < 0 \Rightarrow$  firm has loss)

3.c) From part b., should this firm stay in the market in the short run? Justify your answer.

3.d) Suppose now that the market demand decreases, and the market price decreases to 120 baht per unit. Draw two diagrams to illustrate: (i) the change in the equilibrium price and quantity in the market, (ii) how the change in the market price affects the firm equilibrium quantity and profit. Would your answer from part c. change?

3.c) Yes, this firm should stay in the market. This is because firm cannot adjust the amount of fixed factor at all in short-run, so there is still has fixed cost that firm has to pay for it, even though there's no production. Moreover, this firm is now at least loss situation where  $P > AVC$ , so firm can use the difference between P and AVC to pay for the fixed cost.



↳ when P drops,  $q^*$  also decrease, which leads to less  $\pi$ . And firm will at the  $P = AVC$  condition, which means that the solution zero-unit production and producing & selling at  $q^*$  are give the same amount of benefit.

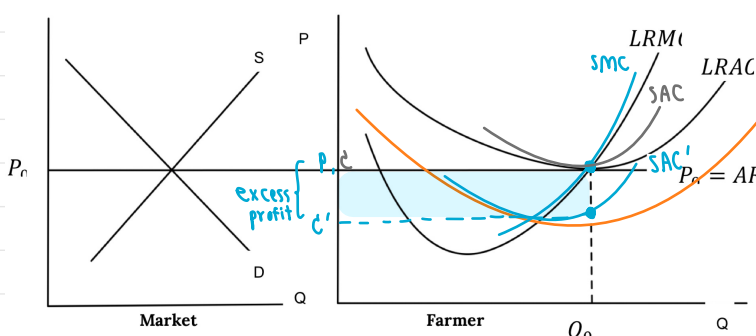
4. A Thai rice farmer is in a long run equilibrium in a perfect competition and produces at the quantity  $Q_0$  as shown in the graph below.

4.a) The government grants a lump sum subsidy to every farmer. How will this change the LRAC? Explain why LRMC does not change.

4.a) The lump sum subsidy will decrease the firm's fixed costs. Additional decreases in fixed cost will not affect the variable costs, so it won't effect LRMC. Then, from  $TC = FC + AC$ , when  $FC \downarrow$ ,  $TC$  also  $\downarrow$ . Then, from  $AC = \frac{TC}{Q}$ , this will make  $LRAC \downarrow$  as well. So LRAC shift down to  $LRAC'$

4.b) (10 Points) Will the lump sum subsidy change the quantity the farmer wants to produce to maximize his profit? Show in the graph that the farmer now earns an Excess Profit.

Explain.  $\rightarrow P > C$  or  $P > AC < AVC$

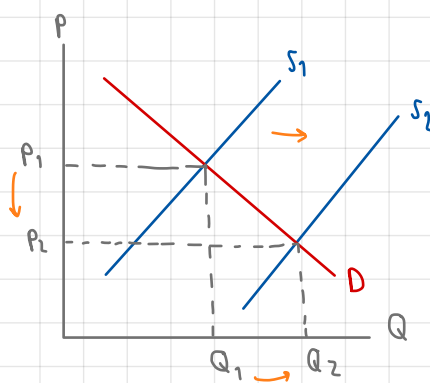
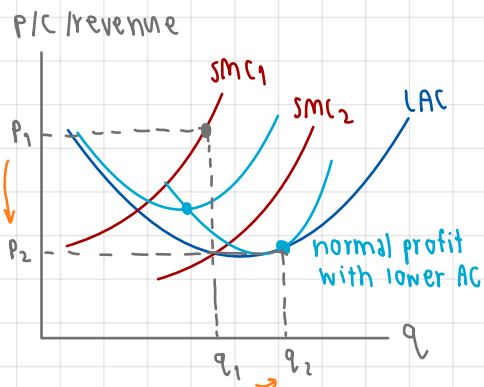


• Due to lower LRAC, we get  $c'$  at  $SAC'$  and  $P$  at  $P_0 = AR$ . With  $p > c'$  or  $(P - C) > 0$ , we get **excess profit**  $= (P - c') \cdot Q_0$

• No because the profit maximization condition is  $P_c = LRMC$ , and since both  $P$  and  $LRMC$  do not change, the optimal  $Q^*$  will remain the same at  $Q_0$ .

4.c) (10 Points) Demonstrate how this Excess Profit will affect the market price in the Long Run that allows new entry to the market.

4.c) Excess profit will attract other firm who's not in this industry to join this mkt. & get this profit. This is because in long-run, there's no barrier to entry the market due to the perfect competition. When more firms join this market, the supply shift right and then affects the market price to decrease in the long run. Consequently, firm tend to receive "normal profit", and achieve the lowest point of the average cost.  $\Rightarrow P_c = LAC = LMC$



5. House and Land (HL) is the monopolist in a luxury housing market. It is a very efficient firm in which workers can construct houses with constant marginal cost and average cost. The demand and cost functions for HL are given as follows. (P is in million-baht unit).

$D = P = 60 - 0.6Q$

$MC = AC = 24$

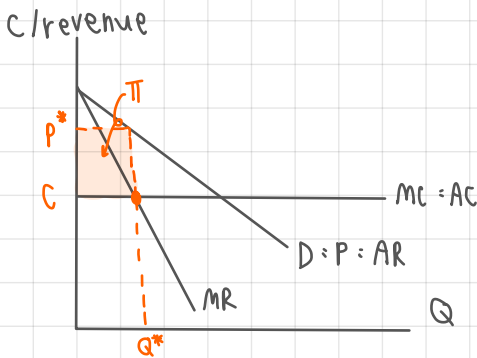
5.a) Derive the marginal revenue function. Draw a diagram to illustrate the demand, marginal revenue, marginal cost, and average cost curves.

5.b) State the profit-maximizing condition for HL, and determine the optimal units of houses. Also, indicate the profit in the diagram, and explain how this profit can be derived.

5.c) The government tries to encourage more people to have access to luxury houses, so they launch a policy forcing HL to sell their houses at the ideal price. Draw another diagram to indicate the ideal price and determine the corresponding quantity at this price. Illustrate the social welfare before and after the intervention in the diagram and discuss.

5.a) For monopoly,  $P = D = AR$  and MR is 2 times steeper than Demand line.

$\therefore$  MR function is  $\Rightarrow MR = 60 - 1.2Q \quad \#$



5.b) Profit maximizing condition  $\Rightarrow MR = MC$

$60 - 1.2Q = 24$

$-1.2Q = -36$

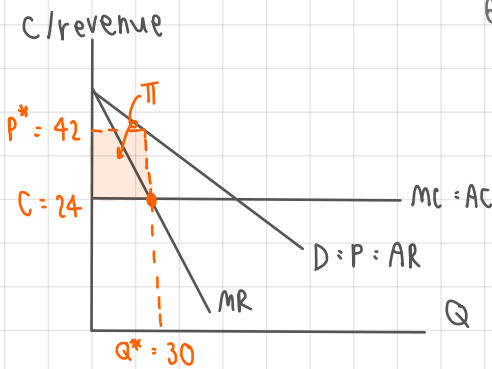
$Q^* = 30$  units of houses  $\#$

$\therefore P^* = 60 - 0.6Q^*$

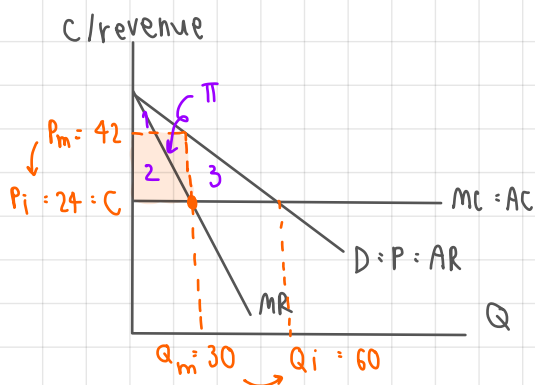
$P^* = 60 - 0.6(30)$

$P^* = 42$  million baht

$\bullet \Pi = (P^* - C) \times Q^* = (42 - 24) \times 30 = 540$  million baht.  $\#$



5.c) Ideal price  $\Rightarrow P = MC = 24$



$P_i = 60 - 0.6Q_i$

$24 = 60 - 0.6Q_i$

$0.6Q_i = 60 - 24$

$Q_i = 60$

- make consumers lose their CS
- change CS to their  $\Pi$

before intervention CS = 1

PS = 2

DWL = 3

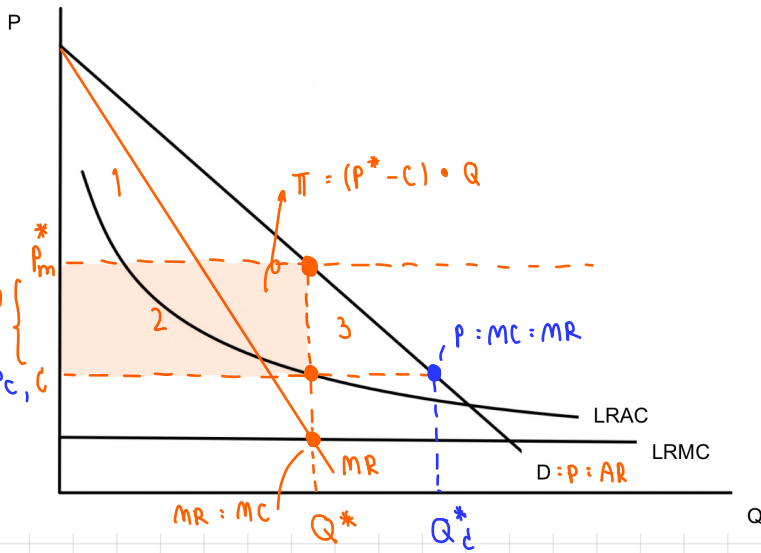
after intervention CS = 1+2+3

PS = -

DWL = -

• When the gov. force HL to sell house at  $P_i$ , the Price will decrease from 42 to 24 and the optimal quantity will increase from 30 to 60. So, more people can access to luxury house due to lower P and more Q. This prevent monopolist to take advantage from consumers

6. a)



Equilibrium  $Q^*$  is at where

$MR = LRMC$  or  $MR = MC$

Or condition to maximize profit or to find firm's eqbm. for monopolist (same with perfect competition)

• Per. Com.  $\Rightarrow$  CS : 1 + 2 + 3

• Monopoly  $\Rightarrow$  CS : 1

Seller's  $\pi$  : 2

$\therefore$  DWL = 3

6. b) Lerner's Index =  $\frac{P - MC}{P} = \frac{50 - 10}{50} = \frac{4}{5} = 0.8 \neq$

6. c) Ideal price  $\Rightarrow$  set price at  $P = MC = \$10$ . Setting the price at ideal price may lead to loss of a monopolist. So, this firm can't earn any profit at this price.

6. d) Fair price  $\Rightarrow$  set price at  $P = AC = LRAC$ . At fair price, monopolist gets normal profit.