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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.

$q = f(K, L)$ in the long run = no fixed factor, $MP_L = 6$, $MP_K = 8$

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?

marginal rate of techical substitution (slope of isoquant)

drop K, get L

$MRTS = \frac{\Delta K}{\Delta L} = \frac{MP_L}{MP_K} = \frac{6}{8} = 0.75$ #

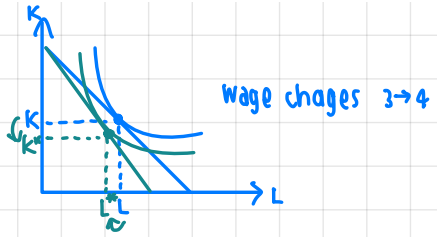
∴ In order to keep the level of output the same, this firm needs to scarifire 0.75 units of capital (K) and get 1 unit of labor back.

∴ cost-minimization condition is $MRTS = MRMS$ (slope of isoquant = slope of isocost)

$\frac{MP_L}{MP_K} = \frac{w}{r} \Rightarrow \frac{MP_L}{w} = \frac{MP_K}{r} \Rightarrow \frac{6}{3} = \frac{8}{r} \Rightarrow r = 4$

at Q_0, $r = \frac{3}{0.75}$ ($3 → wage rate, 0.75 → MRTS) $= \$4$ #

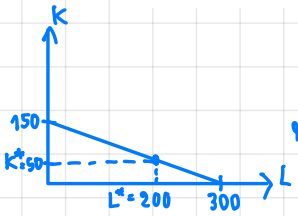
1.b) Suppose now that the wage rate (w) increases to \$4, *ceteris paribus*. Draw a diagram to illustrate the changes in the cost-minimizing combination of inputs.



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 50th machine (MP_K) is 8 bottles of wine.

$q = (K, L)$ in long run, require output = 3,000

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.



$Q^* = 3000$ $TC = L \cdot w + K \cdot r$

$= 200(10) + 50(20)$

q1 intercept: $K = 0 \rightarrow 3000 = 10L \rightarrow L = 300$

$L = 0 \rightarrow 3000 = 20K \rightarrow K = 150$ } use to graph

∴ cost-minimization ⇒ $MRTS = MRMS$ condition $\left|\frac{\Delta K}{\Delta L}\right| = \frac{w}{r} \Rightarrow \left|\frac{-150}{300}\right| = \frac{10}{20} = \frac{1}{2}$ (give 1K gain 2L)

∴ The optimal choice in order to minimize the cost and keep the level of output, Firm sacrifice 1 capital (K) and get 2 labor (L)

$q(K^*, L^*) = q(50, 200)$ #

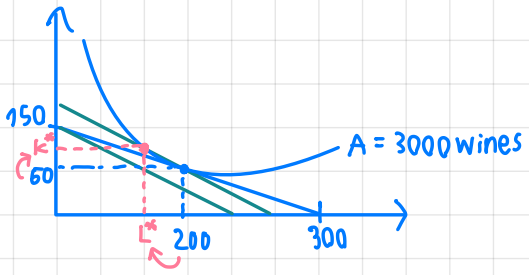
2.b) At the equilibrium in part a., what is the marginal product (MP_L) of the 200th workers?

MP_L of 200th labor = ? → $\frac{MP_L}{MP_K} = \frac{w}{r}$ ⇒ $MP_L = \frac{w}{r} \cdot MP_K$

↗ MP_K of 50th K

$= \frac{10}{20} \cdot 8 = 4 \cdot 4 = 16$

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.



→ (w) Input for L increase 10 → 15

$3000 = 15L + 20K$

When $L = 0$: $3000 = 20K$; $K = 150$

$K = 0$: $3000 = 15L$; $L = 200$

∴ when w ↑, in order to keep the same level of output. Using less labor but more capital. The production become more capital-intensive.

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

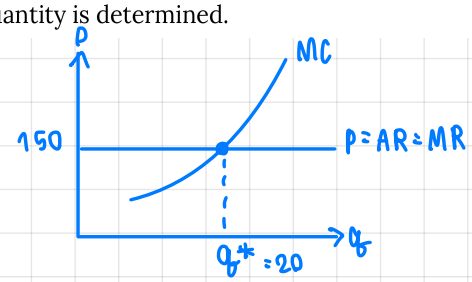
In short-run production, at least 1 factor is fixed as firms take time to expand (K)

In long-run production, all FOP are variable and can be adjusted

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

Perfectly competitive, 150/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.



∴ Profit-maximization condition : MC=MR

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.

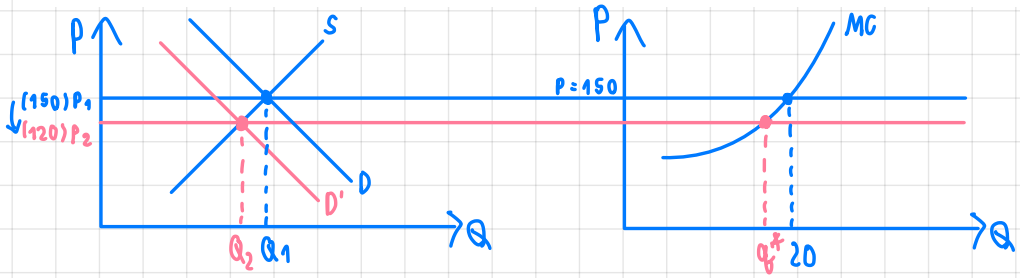
$Q^* = 20$, ATC = 180, AFC = 60

- AVC = ATC − AFC = 180 − 60 = 120 Baht
- TR = P · Q = 150 · 20 = 3000 Baht
- TC = ATC · Q = 180 · 20 = 3600 Baht
- Profit (π) = TR − TC = 3000 − 3600 = −600 Baht (lost)

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

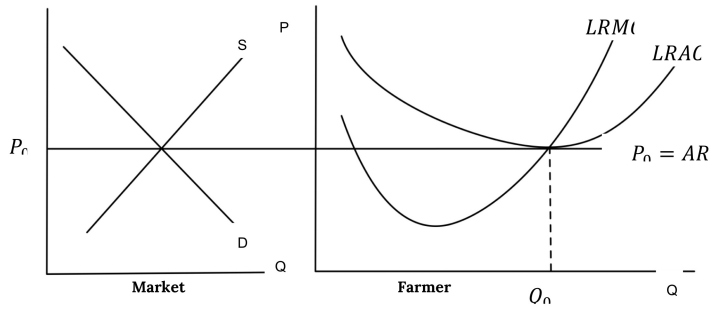
Yes, the firm still should stay in the short-run market eventhough facing loss. This is because the firm is in the least loss situation where P > AVC. The difference between P and AVC still can use for paying the fixed costs since in short-run, fixed factors can't be adjusted.

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?



∴ When price market drops from 150→120, the equilibrium quantity and profit will drop. now P=AVC, keep producing at q^* or stop are indifferent.

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.

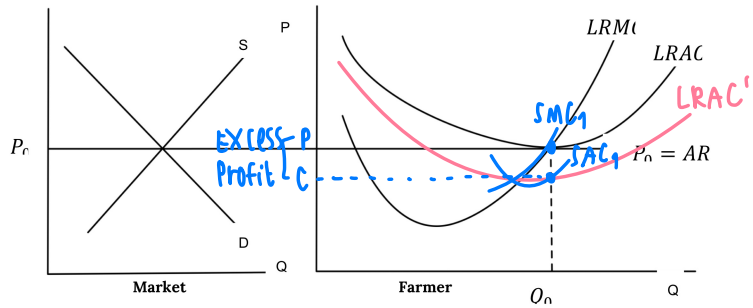


4.a) The government grants a lump sum subsidy to every farmer. How will this change the LRAC? Explain why LRMC does not change.

subsidy will decrease TC. This makes LRAC drops. Since farmer is a price taker in the perfect competition, The competitive price and equilibrium quantity remian constant. So, LRMC has no change as there is no change in q.

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.

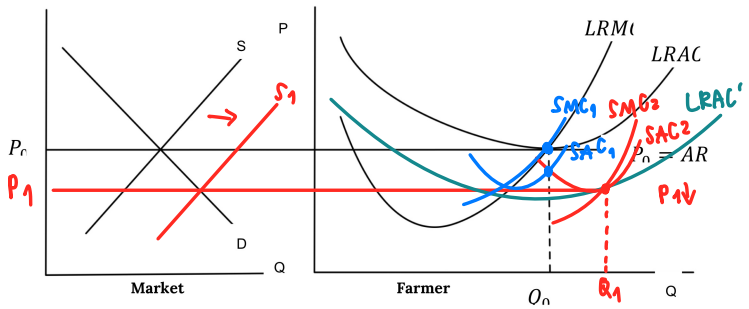
No, because the profit maximization is when P = LRMC. Here, both P and LRMC do not change, the optimal quantity to maximize profit will be the same (Q_0)



- when LRAC ↓, SAC at Q_0 give average cost C.
- when P > C, there is "excess profit"

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.

In long-run, excess profit will attract new farmers to market → supply↑



- when supply ↑, This leads to price drop in market.
- This will increase the optimal quantity to maximize profit.

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).

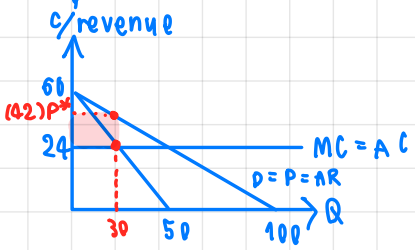
$P = 60 - 0.6Q$

$MC = AC = 24$

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

when D is linear, MR is 2 times steeper.

→ MR: $P = 60 - 1.2Q$



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.

Profit-maximizing condition

$MR = MC$

$60 - 1.2Q = 24$

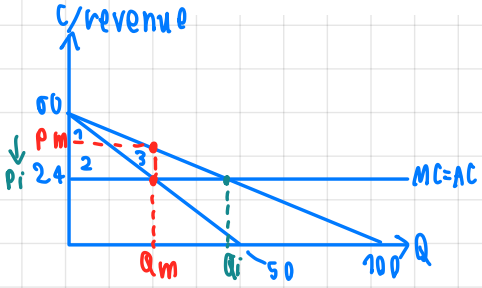
$Q^* = 30$ units #

$P = 60 - 0.6(30) = 42$

∴ Profit (π) $= (P - C) \cdot Q = (42 - 24) \cdot 30 = 540$ MB.

area shaded ↑

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.

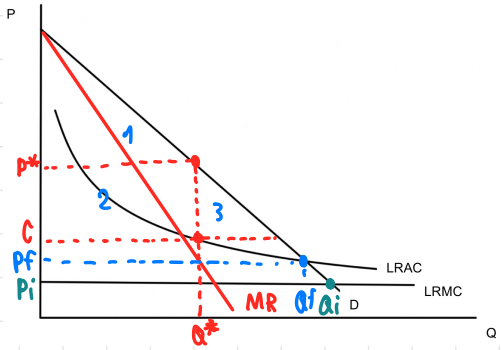


- Ideal Price : $P = MC$
  - quantity ↑ from $Q_m \rightarrow Q_i$
- before intervention
  CS = 1 PS = 2(π) DWL = 3
- after intervention
  CS = 1+2+3 PS = - DWL = -

∴ Intervention prevents HL from taking the advatages from consumer and removes the DWL.

6. The producer of the upcoming vaccine for COVID-19 is a monopoly who wants to price their vaccine to maximize profit. The cost of producing the vaccine is mostly fixed cost involving the research so that the Long Run Average Cost (LRAC) keeps declining the more vaccine is produced. The Long Run Marginal Cost (LRMC) is a small constant cost at all production level.

6.a) If the demand of vaccine is downward sloping as usual, show the equilibrium price and quantity that will maximize the profit. State the equilibrium conditions. Identify the profit and the deadweight loss to the society.



Equilibrium Q^* : MR = LRMC
CS = 1
DWL = 3
Producer's Profit = 2
↳ $(p^* - C) \cdot Q^*$

6.b) Assumed that monopoly price is $50 per dose, marginal cost $10, calculate the Lerner's index of monopoly power.

Lerner's index → $i = \frac{P=MC}{C} \Rightarrow \frac{50-10}{50} = 0.8$

6.c) Determine the Ideal Price? Will the monopoly earn any profit at this Ideal Price? Explain.

Ideal Price → P = MC => 10$ (at Pi, Firm faces loss bc f<LRAC)

6.d) Determine the Fair Price? Is there still deadweight loss at this Fair Price? Explain.

Fair Price → P = LRAC (at Pf, no DWL bc firm is at normal profit)