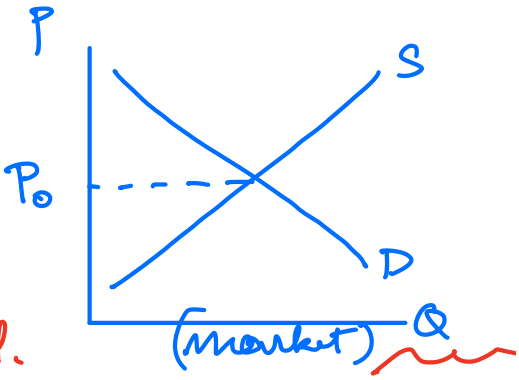
Chapter 18 Perfect Competition in Short Run

The production cost curves can explain the behavior of a firm in perfect competition and monopoly. Here we first look at the behavior of a firm in perfect competition.

Assumptions for market in perfect competition:

1. Many buyers
2. Many sellers
3. Every seller sells essentially the same product (***homogeneous product***) that can perfectly substitute each other's.
4. Every seller has the ***same technology*** and access to the ***same quality and prices of economic resources***.
5. At a given market price P_0, the market demand and market supply respond with a quantity demanded Q_D and a quantity supplied Q_S.
   If $Q_D > Q_S$, then market price increases.
   If $Q_D < Q_S$, then market price decreases.
   $$Excess\ Demand = Q_D - Q_S$$
   $$Excess\ Supply = Q_S - Q_D$$
6. Each firm produces at ***full efficiency***
7. ***Free entry*** and ***free exit***.
8. Every firm wants to ***maximize profit***



no permit required.

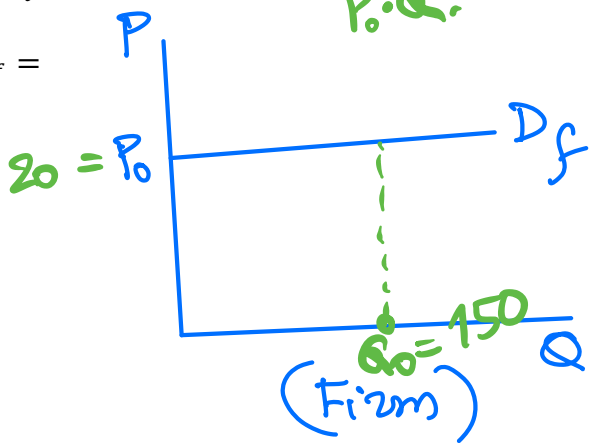
profit $= \pi(Q) = TR(Q) - TC(Q)$

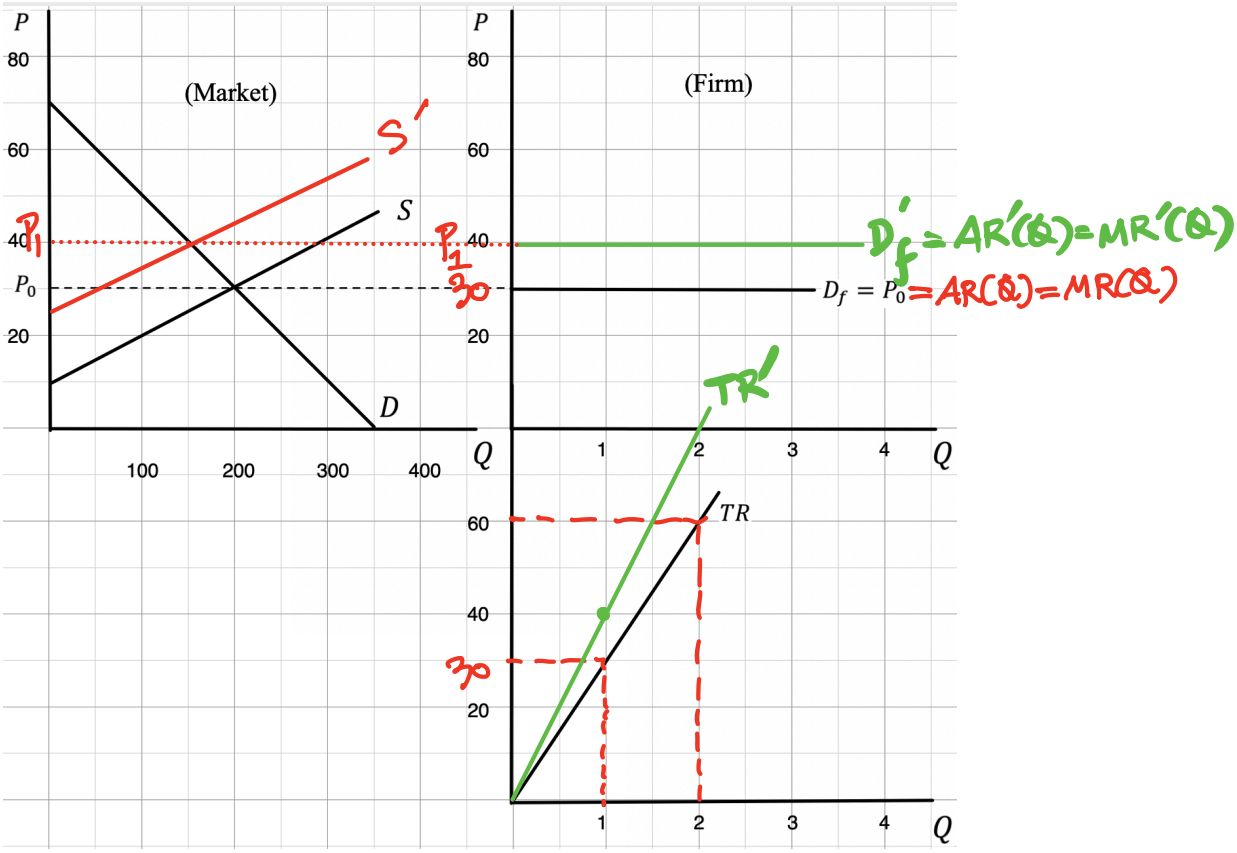
$P_0 \cdot Q$

- From the market equilibrium price P_0, a firm can sell any quantity at price P_0, and zero at any price above P_0.
- Every firm faces the same horizontal demand curve $D_f = P_0$. This is a horizontal demand with intercept at P_0
- The total revenue is given by $TR(Q) = P_0 Q$

$$\Rightarrow MR(Q) = \frac{d}{dQ} TR(Q) = P_0$$

$$\Rightarrow AR(Q) = \frac{TR(Q)}{Q} = P_0$$





- What happens when Market Demand or Market Supply changes?

- **Assumption 8**: Every firm wants to maximize profit
- Profit: $\pi(Q) = TR(Q) - TC(Q)$, is a function of single variable Q.

Calculus of maximizing a function of single variable

Math Statement: A → B

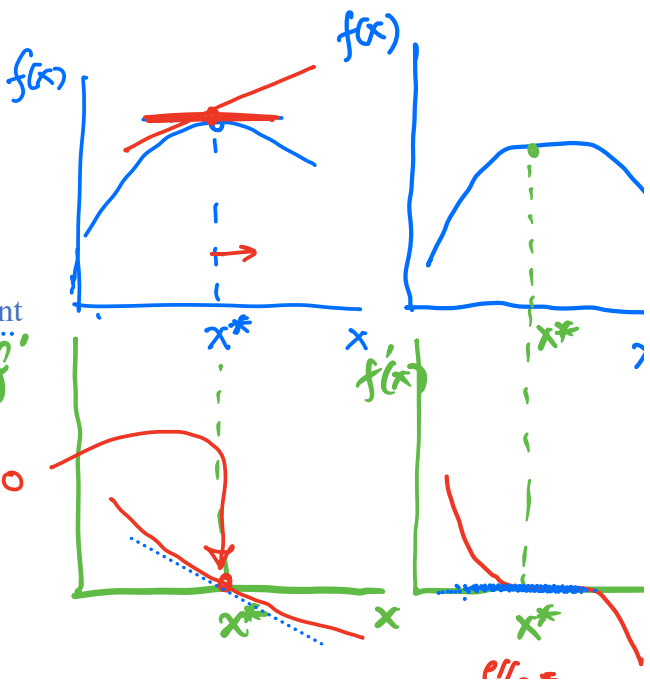
$$y = f(x)$$

Necessary Conditions:

x^* is a maximum point $\Rightarrow$ $\begin{cases} 1.\ f'(x^*) = 0 \\ 2.\ f''(x^*) \le 0 \end{cases}$

Sufficient Conditions:

$\begin{cases} 1.\ f'(x^*) = 0 \\ 2.\ f''(x^*) < 0 \end{cases} \Rightarrow x^*$ is a maximum point



- Sufficient Conditions are used to find a maximum point

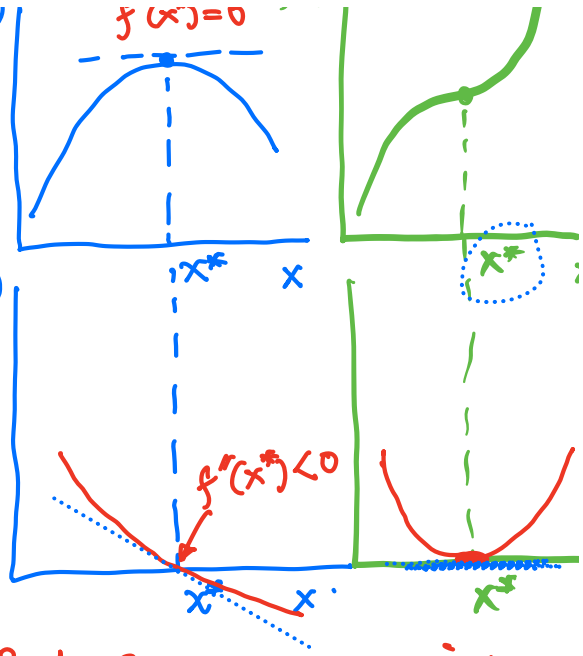
Example $f(x) = 10 + 16x - x^2$

$f'(x^*) = 16 - 2x^* = 0$ $f''(x^*) < 0$

Critical point x^* is found by $f'(x^*) = 0$

$$f'(x^*) = 16 - 2x^* = 0$$
$$x^* = 8$$

Check the second-order sufficient condition: $f''(x^*) = -2 < 0$. We can conclude that $x^* = 8$ maximizes f.



Profit Maximization

- A firm wants to maximize profit

$$\pi(Q) = TR(Q) - TC(Q)$$

First-order Sufficient Condition: at Q^*

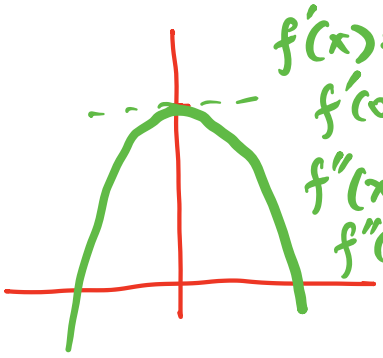
$$\pi'(Q^*) = TR'(Q^*) - TC'(Q^*) = 0$$
$$MR(Q^*) - MC(Q^*) = 0$$
(1) $\rightarrow$ $MR(Q^*) = MC(Q^*)$

But. Sometimes a point x_0 cannot satisfy the Sufficie conditions, it might be a max (min) point.

Second-order Sufficient Condition:

$$\pi''(Q^*) = TR'(Q^*) - TC''(Q^*) < 0$$
$$MR'(Q^*) - MC'(Q^*) < 0$$
(2) $\rightarrow$ $slope\ of\ MR(Q^*) < slope\ of\ MC(Q^*)$

Ex max $f(x) = -x^4 + 1$
$f'(x) = -4x^3$
$f'(0) = 0$
$f''(x) = -12x$
$f''(0) = 0$

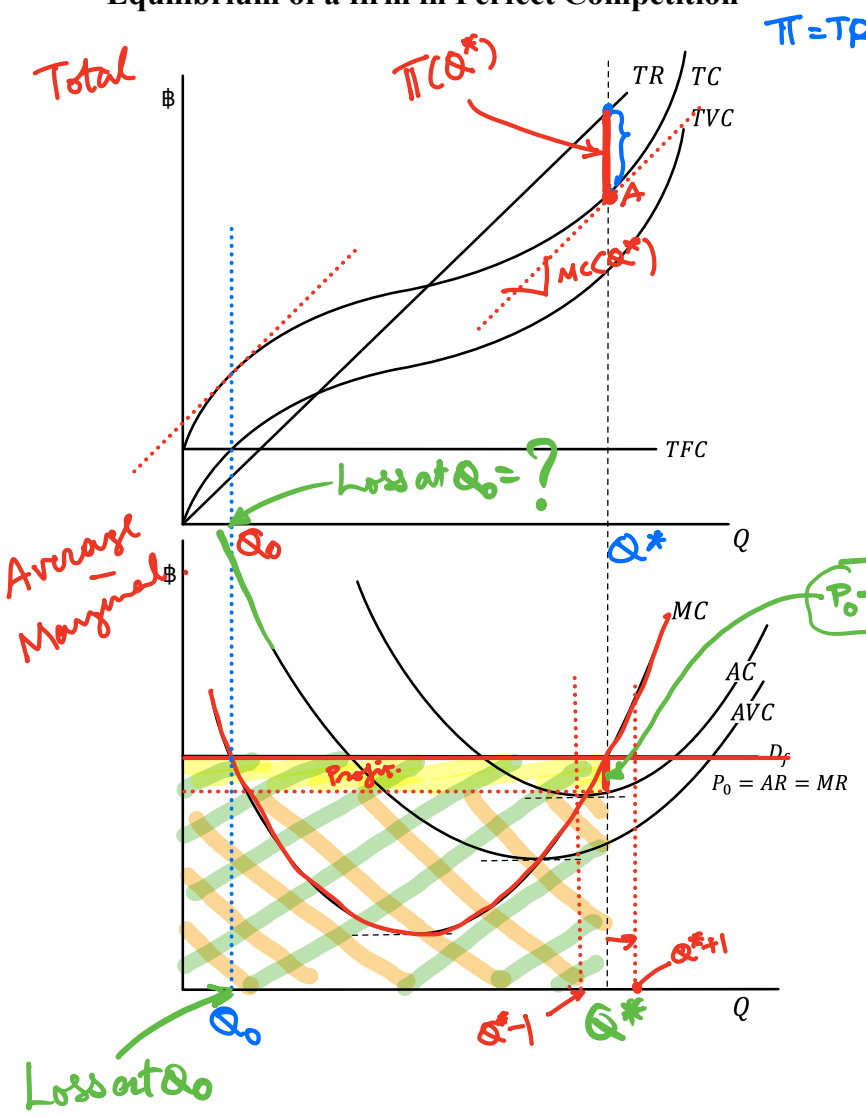


Equilibrium Conditions: A firm to maximize profit at Q^* if
✓1) $MR(Q^*) = MC(Q^*)$
✓2) $slope\ of\ MR(Q^*) < slope\ of\ MC(Q^*)$.

Ex. $f(x) = 10 - x^3$
Some one say $x^* = 0$ is max
Check Necessary Conditions
1) $f'(x) = -3x^2$
$f'(0) = 0$ ✓
2) $f''(x) = -6x$
$f''(0) = 0$ ✓
$\rightarrow$ Satisfy Necessary Conditions
But we cannot say that $x^* = 0$ is the max pt.

Necessary Conditions cannot be used to support conclusion th a point is max.

Equilibrium of a firm in Perfect Competition



- $MR = MC$ alone is not sufficient to guarantee a maximum profit.
- A firm does not maximize profit at the quantity that maximizes average profit/unit.
- **Equilibrium Conditions:** A firm to maximize profit at Q^* if
  1) $MR(Q^*) = MC(Q^*)$
  2) $slope\ of\ MR(Q^*) < slope\ of\ MC(Q^*)$.

Q^* satisfies
1) $MR(Q^*) = MC(Q^*)$
2) slope MR(Q^*) < slope MC(Q^*)
= 0 > 0
$\therefore Q^*$ maximizes profit.

at Q_0, $MR(Q_0) = MC(Q_0)$
but slope MR(Q_0) > slope MC
= 0 < 0
Actually Q_0 satisfies the sufficient condition that it minimizes profit

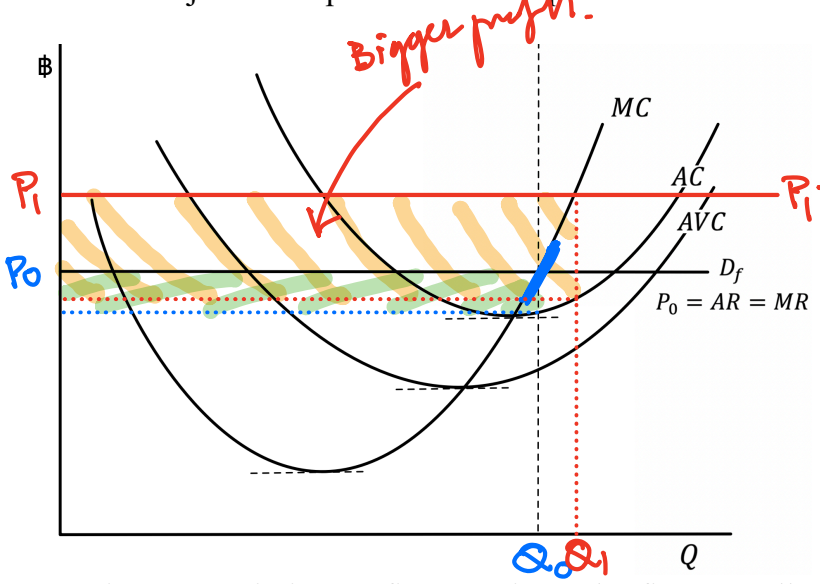
At Q^*, $TR(Q^*) = Q^* \cdot P_0$
$TC(Q^*) = Q^* \cdot AC(Q^*)$
$\pi(Q^*) = TR(Q^*) - TC(Q^*)$
$= Q^* P_0 - Q^* AC(Q^*)$
$= Q^*(P_0 - AC(Q^*))$

Note Q^* does not have to be where AC is minimum

Economists make decision on the marginal concept.
Not the total concept.

Changes of Equilibrium of a firm in Perfect Competition

1. If the market price increases (due to an increase in Market Demand and/or decrease in Market Supply, the firm will adjust its output to maximize profit.



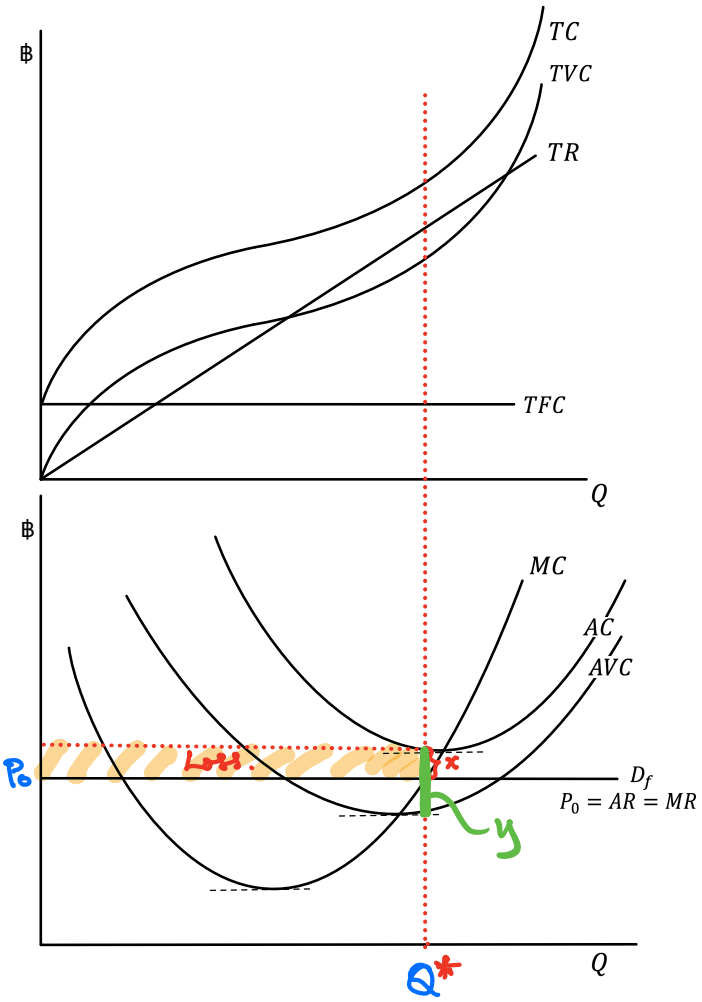
- Trying to maximize profit, sometimes the firm actually makes a loss—if market price is so low.

① Price
② Cost - Fixed
③ Cost - Variable

Initially the Eq. is at Q_0
where 1) $MR(Q_0) = P_0 = MC($
2) slope $MR(Q_0) = 0$
< slope $MC(Q_0)$

The firm will sell at $Q_1 > Q$
where the profit is maximu
because
1) $MR(Q_1) = P_1 = MC(Q_1)$
2) slope $(MR(Q_1) = 0$
< slope $MC(Q_1)$

Question. Is higher price always leads to higher Q?
Yes, because MC is increasi
slope of $MC(Q_0) > 0$



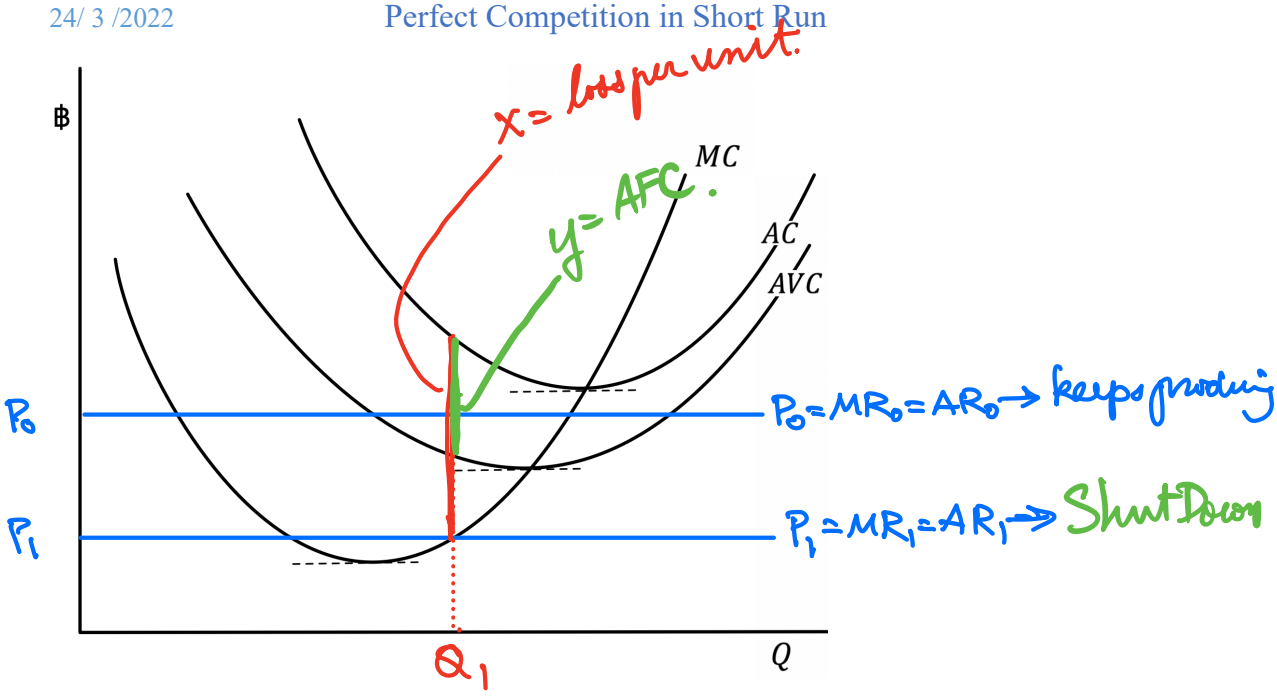
- When the firm is making at loss at Q^*, do you think the firm should shut down?
- There are two options:
  1) Continue and produce Q^*, and lose = $x \cdot Q^* = Loss$.
  2) Shut down and produce $Q = 0$, and lose = $TFC = y \cdot Q^*$

Recall that, $AFC(Q) = AC(Q) - AVC(Q)$.

- In short run, the firm will shut down when $Loss > TFC$.

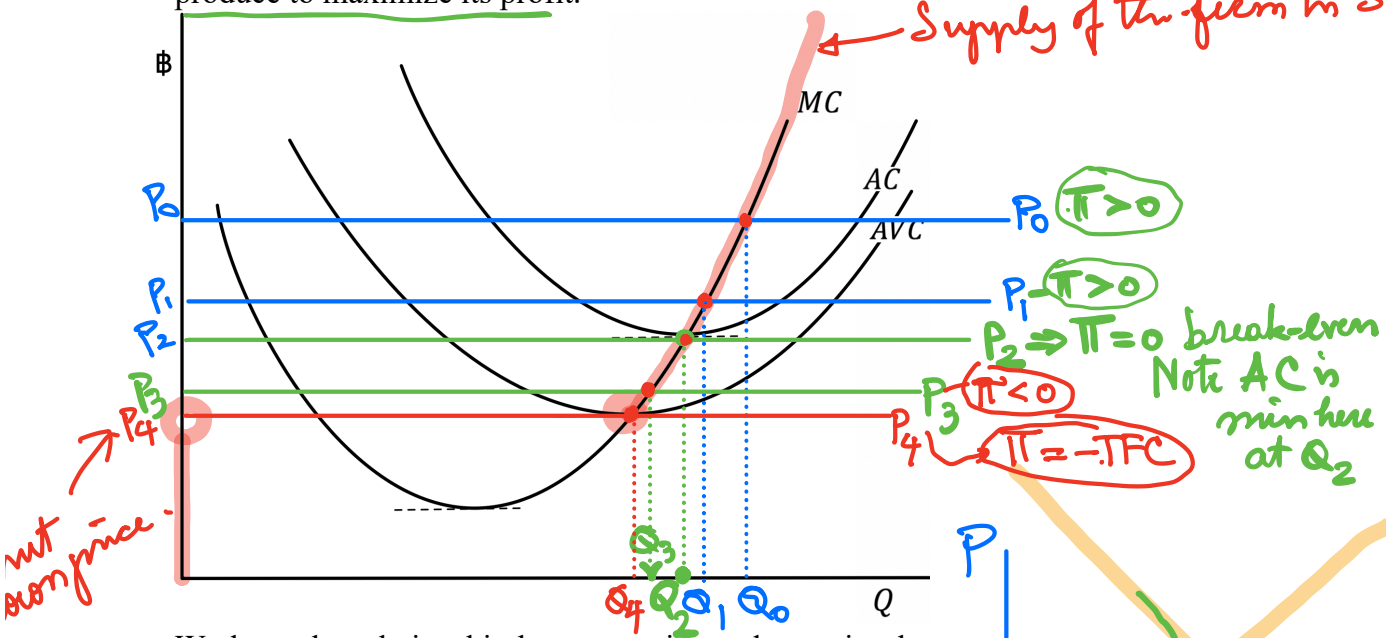
$TFC > Loss$
$y \cdot Q^* > x \cdot Q^*$

Can recover part of the TFC.
⇒ still keeps producing.

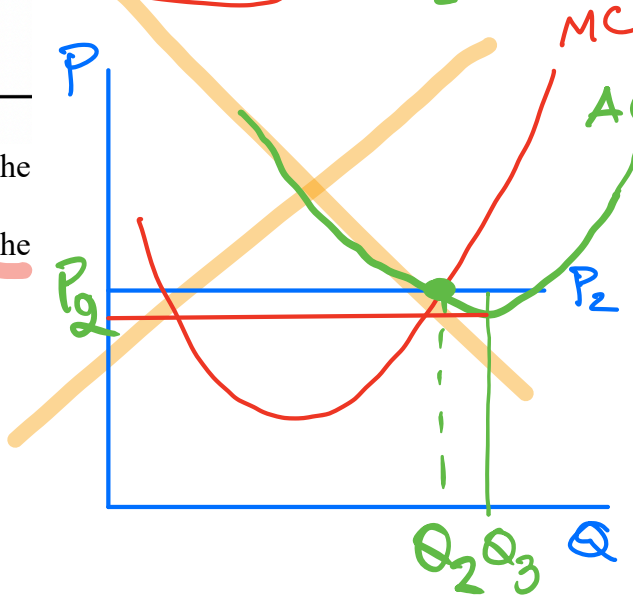


- The price at the minimum of AVC is ***the shut-down price*** in short run—this is where the firm either shuts down or continues with profit = 0.

- We can derive the following relationship between the prevailing equilibrium price and the quantity the firm will produce to maximize its profit.

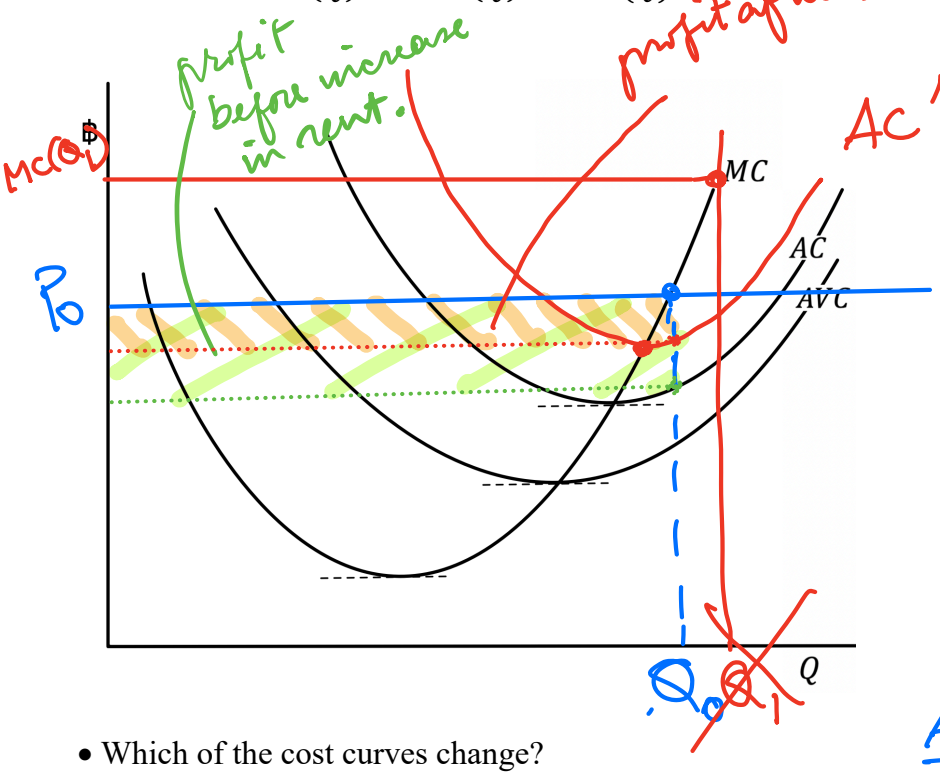


- We have the relationship between price and quantity the firm is ***able*** and ***willing*** to produce in short-run.
- Short-Run Supply Curve of a firm is the MC from the minimum of AVC upward.



2. The firm is charges an increase in rent. This means the TFC/TVC increases.

$$TC(Q) = TFC(Q) + TVC(Q)$$
$$TC'(Q) = TFC'(Q) + TVC(Q)$$



- Which of the cost curves change?
- Will the firm change the quantity to produce? Check the equilibrium conditions:

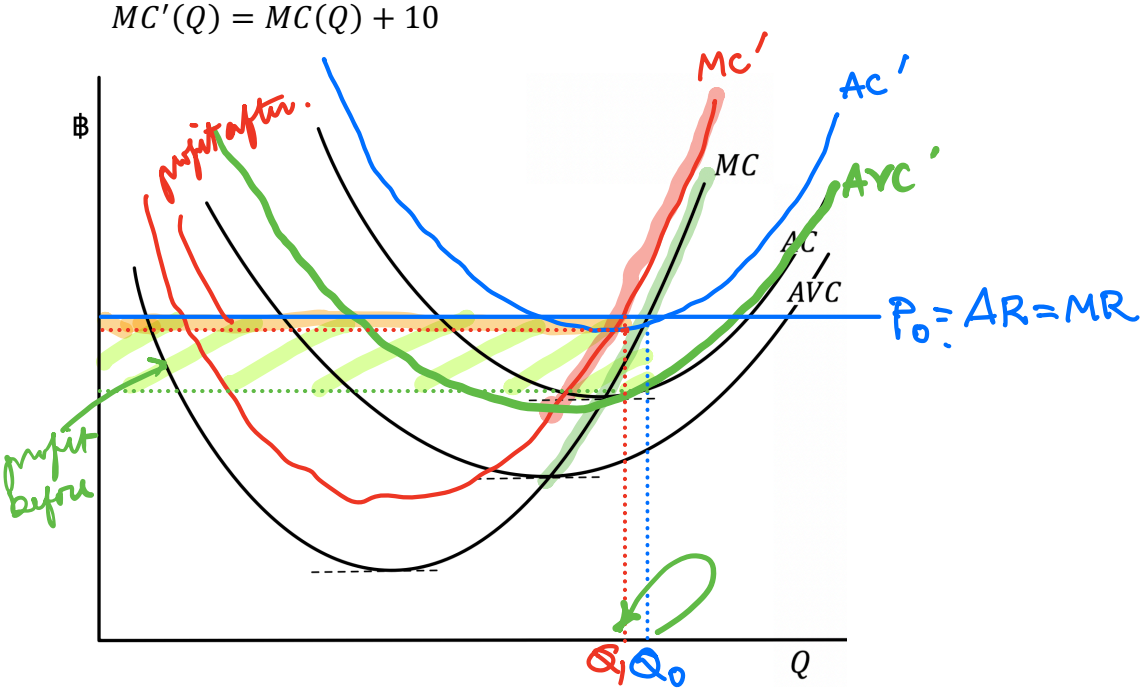
- Does the profit of the firm decrease?

Questions:
1. If the rent increases, can the firm receive a loss and still continue to stay in the market?
2. Can the rent increase cause the firm to produce more?
3. Can the rent increase cause the change in the SR supply?

3. The government imposes tax $= 10\ baht s/unit$—this means the TFC/TVC changes.

$$TC(Q) = TFC(Q) + TVC(Q)$$
$$TC'(Q) = TFC(Q) + TVC'(Q)$$
$$= TFC(Q) + TVC(Q) + 10Q$$

$$AVC'(Q) = AVC(Q) + 10$$
$$AC'(Q) = AFC(Q) + AVC(Q) + 10 = AC(Q) + 10$$
$$MC'(Q) = MC(Q) + 10$$



- State the equilibrium conditions before and after the tax.

Before: at Q_0,
1) MR = MC(Q_0)
2) slope MR < slope MC(Q_0)

after: at Q_1
1) MR = MC(Q_1)
2) slope MR < slope MC(Q_1)

- Does the firm change the quantity to produce to maximize profit? Yes. produce less from Q_0 to Q_1
- Does the firm receive less/more profit?
- Does the firm's Short-Run Supply change? — Yes, Supply shifts up (decrease) by moving upward vertically = tax = 10฿

HW. Analyze the case the firm receives subsidy for the following two different cases to find out how the firm changes its quantity to produce and the profit received.

a) The government gives a lump sum subsidy of 20,000 bahts to each firm.

b) Suppose that the firm was producing 1,000 units and the government gives a subsidy of 20 bahts/unit so the total subsidy is also 20,000 bahts if the firm does not change its production of 1,000 units. Do you think, to maximize its profit with the subsidy of 20 bahts/unit, the firm will increase/decrease its production from 1,000 units? Does the firm receive higher profit? Does the firm receive more/less subsidy than 20,000 bahts?

which one the firm would prefer?