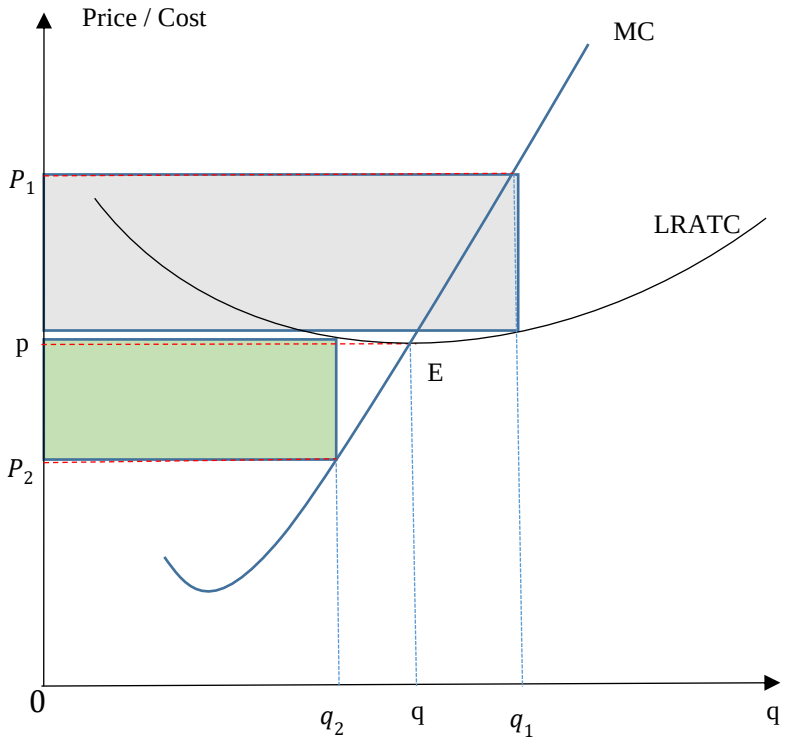
L11 – Competition In the Long-Run

Maximize profit: $\pi(q) = TR(q) - TC(q)$

1. LR Optimal quantity

$$MR(q^*) = MC(q^*)$$
$$P = MC(q^*)$$



❖ Note that the LRMC curve is different from the SRMC curve

2. Entry and Exit Decision

❖ Firm exits if: TR < TC
Divide both sides by q: TR/q < TC/q

Firm exits if P < ATC.

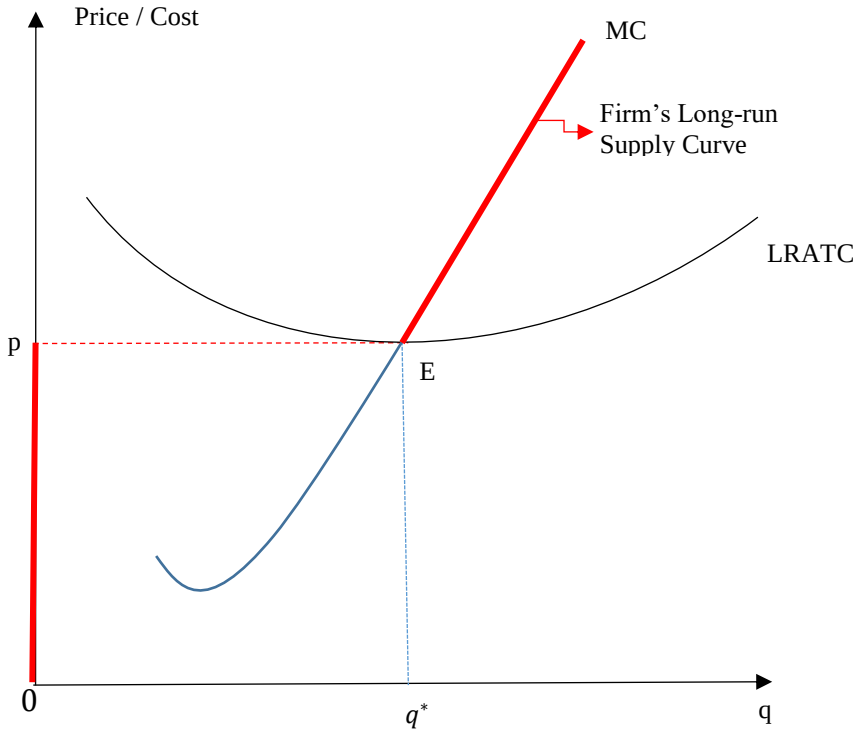
❖ Firm enters if: TR > TC
Divide both sides by q: TR/q > TC/q

Firm enters if P > ATC.

If:	The Firm Will:
P > *ATC*	Enter because economic profits are earned
P = *ATC*	Neither enter nor exit because economic profits are zero
P < *ATC*	Exit because economic losses are incurred

3. LR Individual Firm's Supply Curve

- When the price is higher than min(ATC), the firm's supply curve is identical to the part of MC curve that is above the ATC curve.
- When the price is lower than min(ATC), q=0.



4. LR Market Supply Curve

Question: Can we just add up firms' supply curves to get the market supply curve, as we did in the short-run case?

1) If firms in an industry are earning profit, this will attract new firms.

   a) The supply of the product will increase (the supply curve will shift to the right).

   b) The price of the product will fall and profit will decline. (Each firm is a price taker and its decision on the quantity does not change the price. But when firms enter or exit the market, supply curve shifts and the price changes. See the figure in the last page.)

2) If firms in an industry are incurring losses, firms will exit.

   a) The supply of the product will decrease (the supply curve will shift to the left).

   b) The price of the product will rise and losses will decline.

3) At the end of this process of entry or exit, firms that remain in the market must be making zero economic profit.

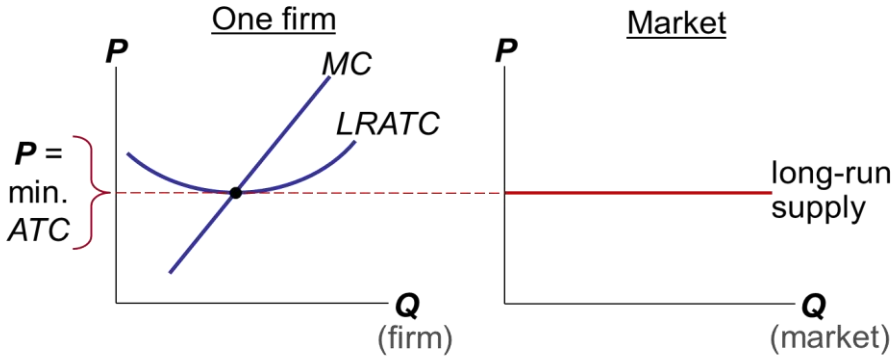
4) In a market with free entry and exit, there is only one price consistent with zero profit – the minimum of average total cost.

P = min(ATC)

5) This implies that the long-run equilibrium of a competitive market must have firms operating at their efficient scale.

In the long run, the typical firm earns zero profit.

The LR market supply curve is horizontal at ***P*** = minimum *ATC*.



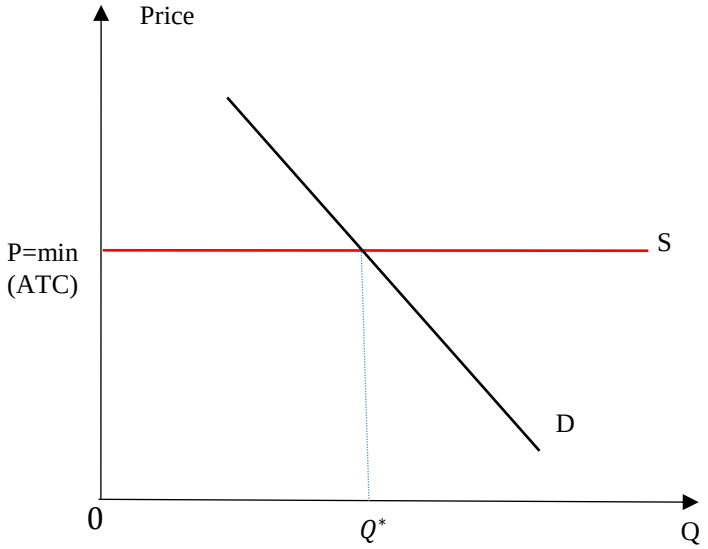
Remarks:

- The long-run market price is determined only by the firm's technology (production or cost function), but not by the market demand, the number of firms.
- So is the long-run output of each firm determined only by the firm's technology.

Question 1: Why do competitive firms stay in business if they make zero profit?

Question 2: What determines the market output?

5. LR Market equilibrium



- Market price is equal to the minimum of the ATC
- Market quantity is determined by the interaction point of the demand and supply curves.

- The number of firms in the market equilibrium is equal to $\frac{Q^*}{q^*}$, where Q^* is the market output and q^* is the output of each firm.

Question 3:
$C(q) = 4 + q^2, MC = 2q$. The demand function is $Q_D = 28 - p$. What is the long-run equilibrium (price, quantity, number of firms, output of each firm, profit)? Compare this with the short-run equilibrium.

In the long run, $p = minATC$. The minimum of ATC is reached at when ATC=MC. That is, $4/q + q = 2q \Rightarrow q = 2$. $p = 4$. So $Q = 28 - p = 24$. The number of firms $n = Q/q = 12$.

1. A Shift in Demand in the SR and LR

1) Assume that the market begins in LR equilibrium. This means that firms are earning zero profit and price equals the minimum of ATC.

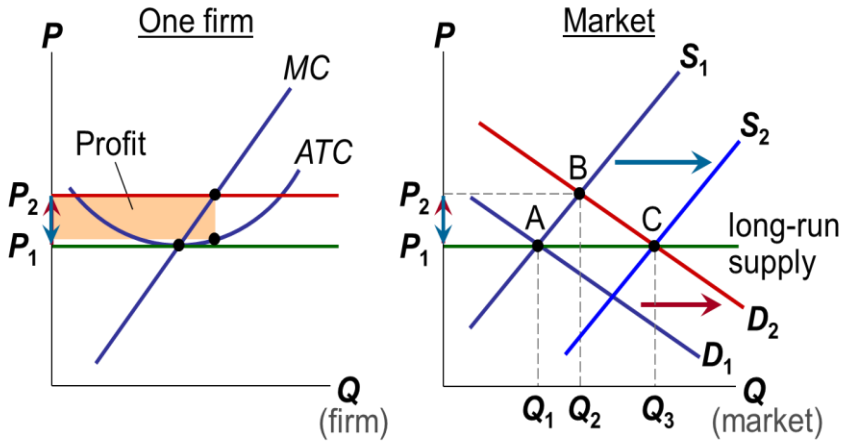
2) If the demand for the product increases, this will lead to an increase in the price of the good (since in the short-run the number of the firms does not change).

3) Firms will respond to the increase in price by producing more in the short run.

4) Because price is now greater than average total cost, firms are earning profit.

5) The profit will attract new firms into the industry, shifting the supply curve to the right.

6) This will lower price until it falls back to the minimum of average total cost and firms are once again earning zero economic profit.



2. Why the Long-Run Supply Curve Might Slope Upward

In reality many LR supply curves slope upward. How to explain the discrepancy?

A horizontal supply curve happens in a perfectly competitive market. When some of the assumptions about the perfectly competitive market are violated, we may observe upward sloping supply curve.

Here are a few examples:

1) *When entry is limited.*
   If the number of the firms in a market is limited in the long run, the market supply curves may slope upward.

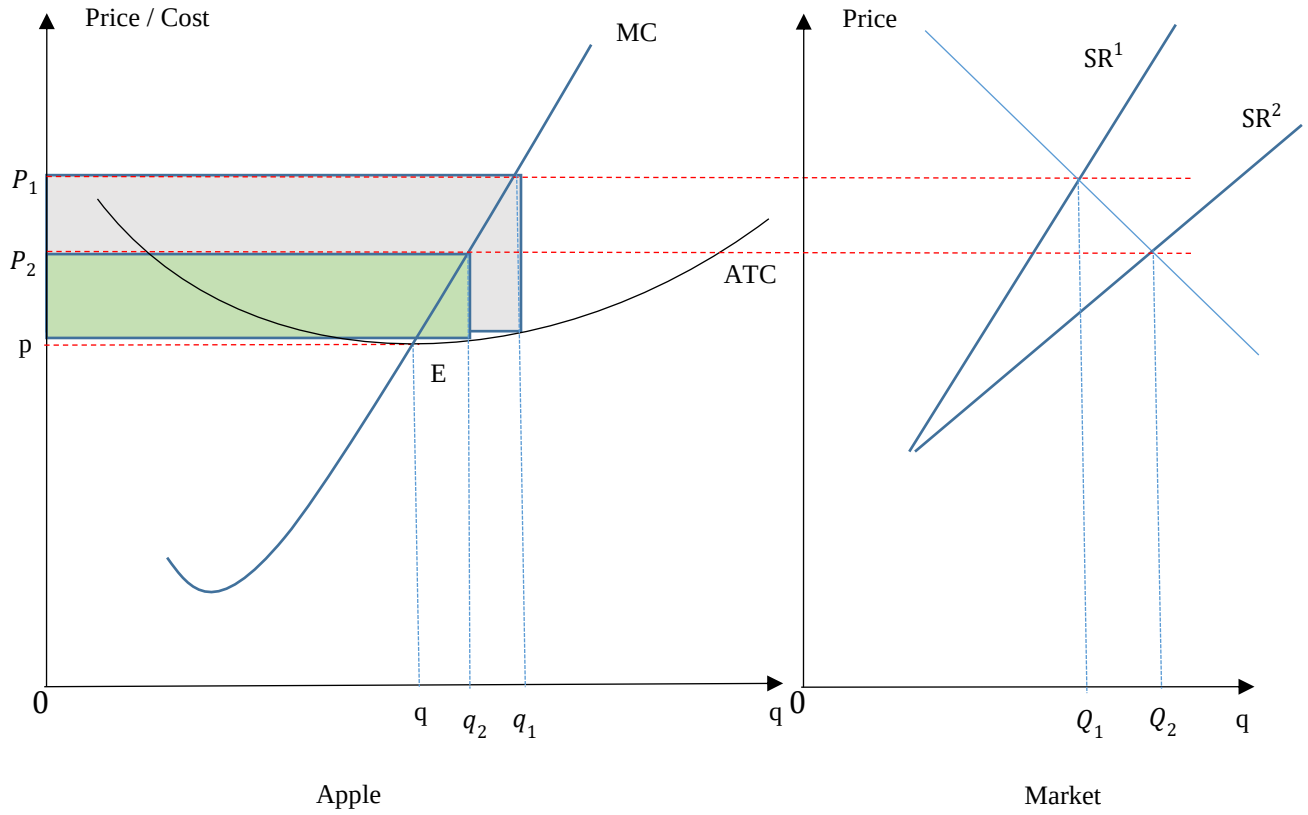
2) *When firms differ.*
   When the price is low, only low-cost firms enter the market. When the price is high enough, high-cost firms enter the market too, while the low-cost firms earn a larger profit.

3) *When input prices increases with the output.*
   The competition ensures that P=min(ATC). But in this case the min(ATC) increases with the output. Therefore the price P increases with the output.

Question 1: If the cost function is $C(q) = 100 + 10q - q^2 + \frac{1}{3}q^3$, and $MC(q) = 10 - 2q + q^2$. What is the firm's profit-maximizing condition?

Question 2: Each firm in a competitive market has a cost function of $C = 16 + q^2$. The market demand function is $Q_d = 24 - p$. Determine the long-run equilibrium price, quantity per firm, market quantity, and number of firms.

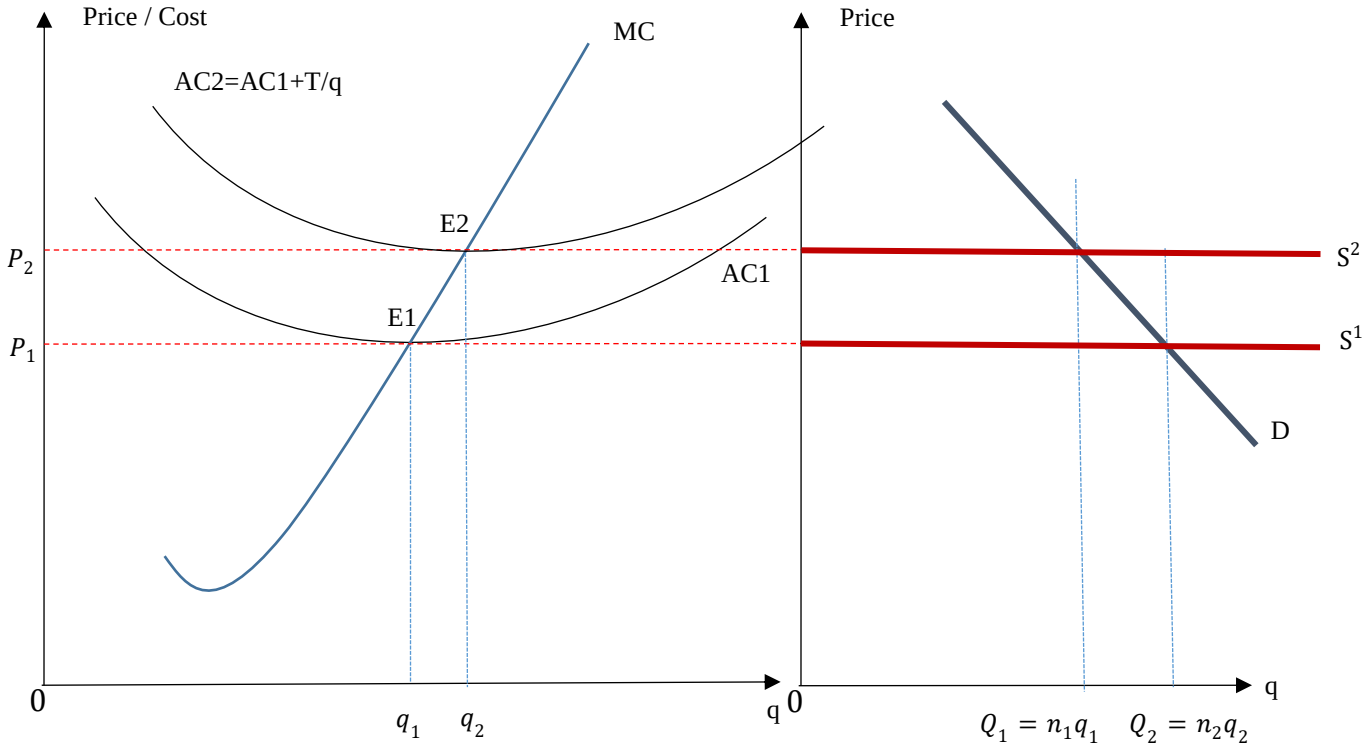
1. When new firms enter the market, the price falls and the profit is lower.



Apple

Market

2. When the government collects a lump-sum franchise tax of T from each firm, how do the long-run market and firm equilibrium change?



Firm

Market

Answer:

a. The lump-sum tax causes the minimum long-run AC to rise, but does not change the MC;

b. The shift in the minimum AC causes the market supply curve to shift upward, equilibrium quantity to fall, and equilibrium price to rise;

c. The increase in the equilibrium price causes output of an individual firm to rise;

d. Use the market quantity and individual firm quantity to determine how the number of firms changes: $n_1 = \frac{Q_1}{q_1}$, $n_2 = \frac{Q_2}{q_2}$.