Microeconomics, Module 8, “Competitive Firm in the Long Run” (Chapter 7)

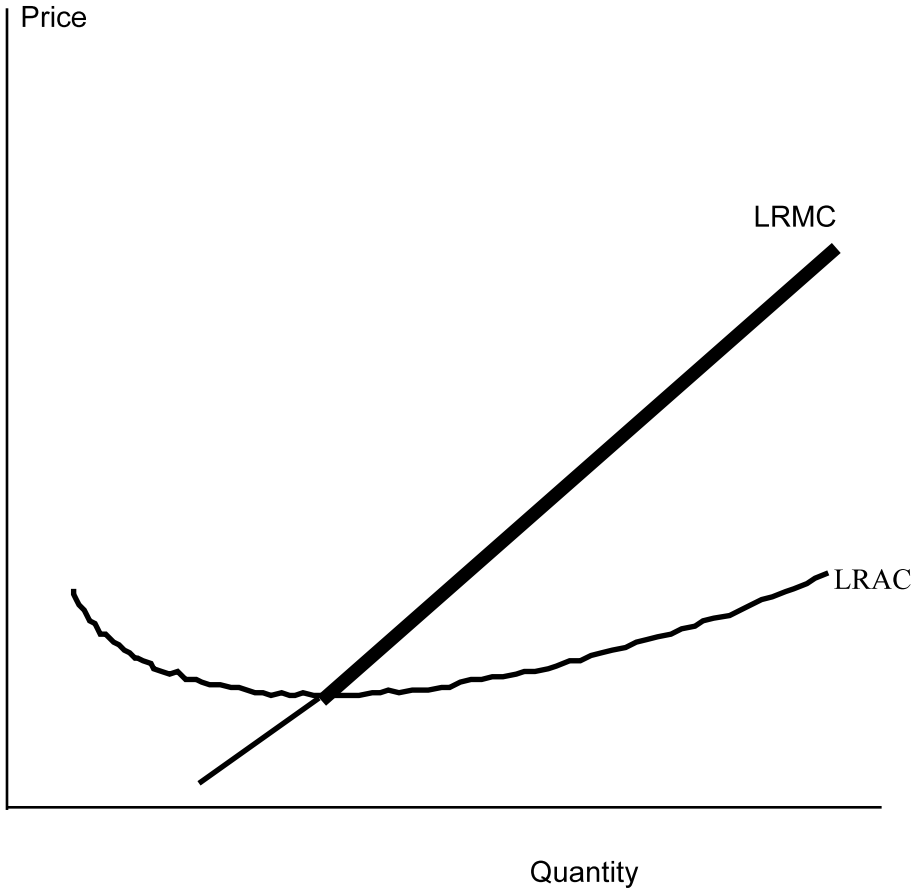
(Overview and Concepts)

(See the attached PDF file.)

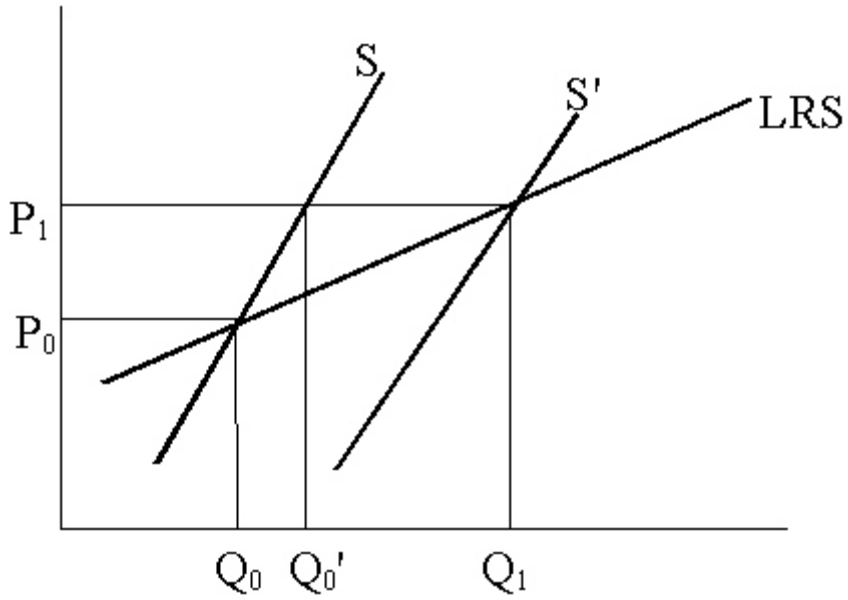
The *long-run supply curve* corresponds with the *long-run marginal cost* curve.

If profits are negative (price is less than average cost), the firm *exits* the industry.

The long run supply curve (LRSC) is the portion of the long-run marginal cost curve (LRMC) that lies above the long-run average cost curve (LRAC).



The long-run supply curve is *more elastic* than the short run supply curve.



If price changes from P_0 to P_1, the firm moves its *short run supply* to Q_0'.

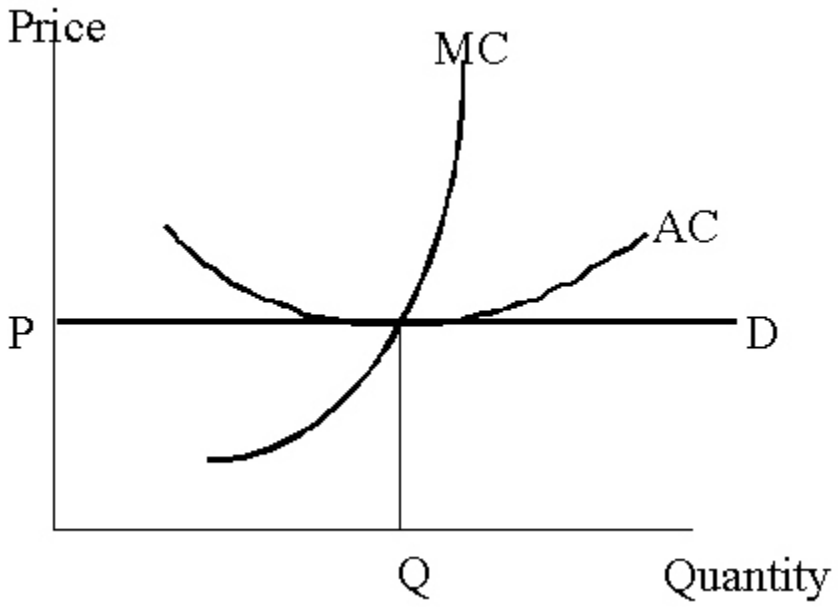
In the *long-run*, the firm varies its plant capacity to S' and its quantity to Q_1.

Competitive Industry in Long Run

Economic profit (above a normal return on capital) is zero in the long-run.

The long-run situation of the firm is summarized by 3 curves:

- Long-run marginal cost curve
- Long-run average cost curve
- Demand curve



In the long-run:

- The *marginal cost* is the *market price* and there is *no excess profit*.
- The price is at the *minimum* of the average cost curve.
- Firms produce at *lowest possible average cost*.

Competitive Industry in Long Run: Equilibrium

For some exam problems:

Determine the *market price* from the *industry supply and demand* curves. For individual firms, the demand curve is flat at the market price.

The relation between the industry and the firm is the same in the long run as in the short run. The difference between the short and long-run relates to changes in equilibrium:

- Short run profits don't affect anything.
- Long-run profits cause entry (if positive) or exit (if negative).

Changes in equilibrium

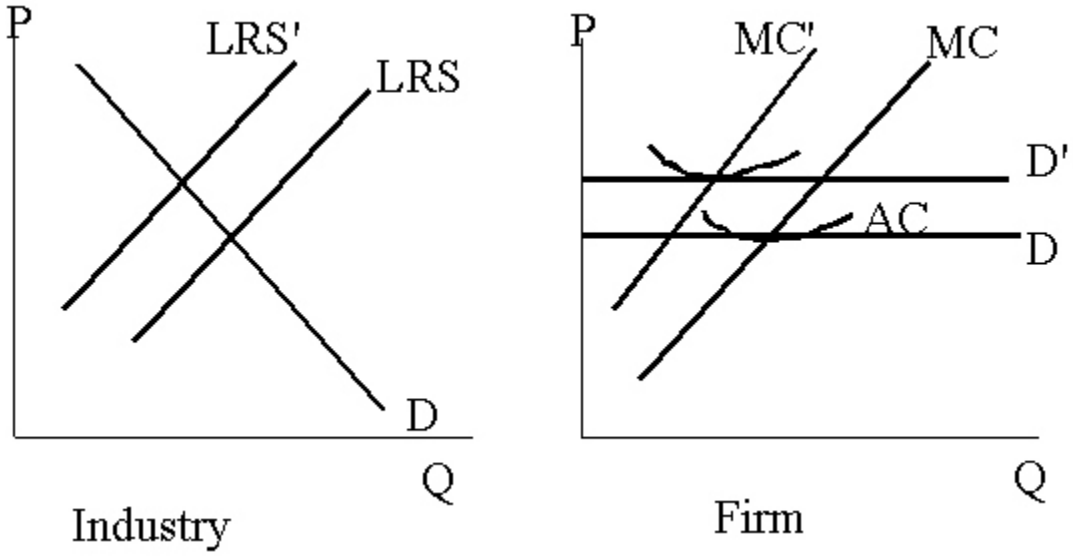
Changes in marginal cost:

An increase in variable costs causes average costs and marginal cost to shift up.

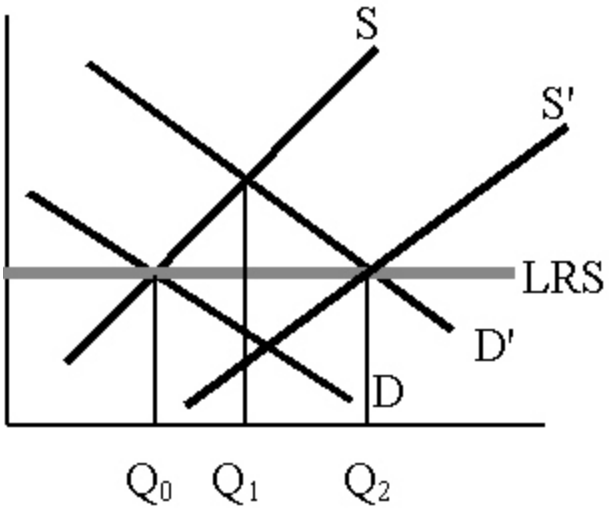
The industry supply curve shifts left for *two reasons*:

- Each firm's supply curve shifts.
- Some firms exit.

Increasing Cost Case



Changes in Demand



Constant Cost Industry

S and S' are short run supply curves; D and D′ are demand curves.

If D increases to D', quantity increases from Q_0 to Q_1, then to Q_2.

New firms enter because the price rises. This is

- a movement *of* the *short run* supply curve
- a movement *along* the long-run supply curve

Exercise 8.1:

(Adapted from question 29 of the Spring 1997 actuarial exam)

Suppose that the insurance industry consists of identical insurers, each with marginal cost of $Q^{½}$ for output of Q insurance policies and fixed costs of ⅓ × \$1 million (\$333,333.33). There is an unlimited number of firms that could produce in the industry with these cost curves. The industry demand curve is Q = 1,000,000 – 5,000P.

A. What is the total cost curve?
B. What is the variable cost curve?
C. What is the average cost curve?
D. In long-run competitive equilibrium, how many policies does each insurer underwrite?
E. What is the price of a policy?
F. How many policies are written in the industry?
G. How many insurers compete in this industry?

Solution 8.1:

Part A: The total cost curve is the integral of the marginal cost curve:

$$\int \sqrt{Q}\, dQ = \tfrac{2}{3} Q^{3/2} + \textit{fixed costs}$$

Fixed costs are ⅓ × \$1 million.

Part B: The variable cost curve is $\frac{2}{3}Q^{1.5}$ (= total costs – fixed costs).

Part C: The average cost = total cost ÷ Q:

$$\tfrac{2}{3} Q^{1/2} + \frac{\$1{,}000{,}000}{3Q}.$$

Part D: In the long-run competitive equilibrium, price = marginal cost = average cost. We find the equilibrium quantity by equating marginal cost and average cost:

$$Q^{1/2} = \tfrac{2}{3}\, Q^{1/2} + \$1{,}000{,}000 / 3Q$$
$$Q^{1.5} = 1{,}000{,}000$$
$$Q = 10{,}000$$

Alternatively, we find Q by solving for the point of minimum average cost, which is the point where the partial derivative of average cost with respect to Q equals zero:

$$\partial/\partial Q \left\{ \tfrac{2}{3} Q^{1/2} + \frac{\$1{,}000{,}000}{3Q} \right\} = 0$$
$$\tfrac{1}{3}\, Q^{-1/2} - \$1{,}000{,}000 / 3Q^2 = 0$$
$$Q^{1.5} = 1{,}000{,}000$$
$$Q = 10{,}000$$

Each insurer writes 10,000 policies.

Part E: The price per policy is the marginal cost: $P = Q^{1/2} = \$100$

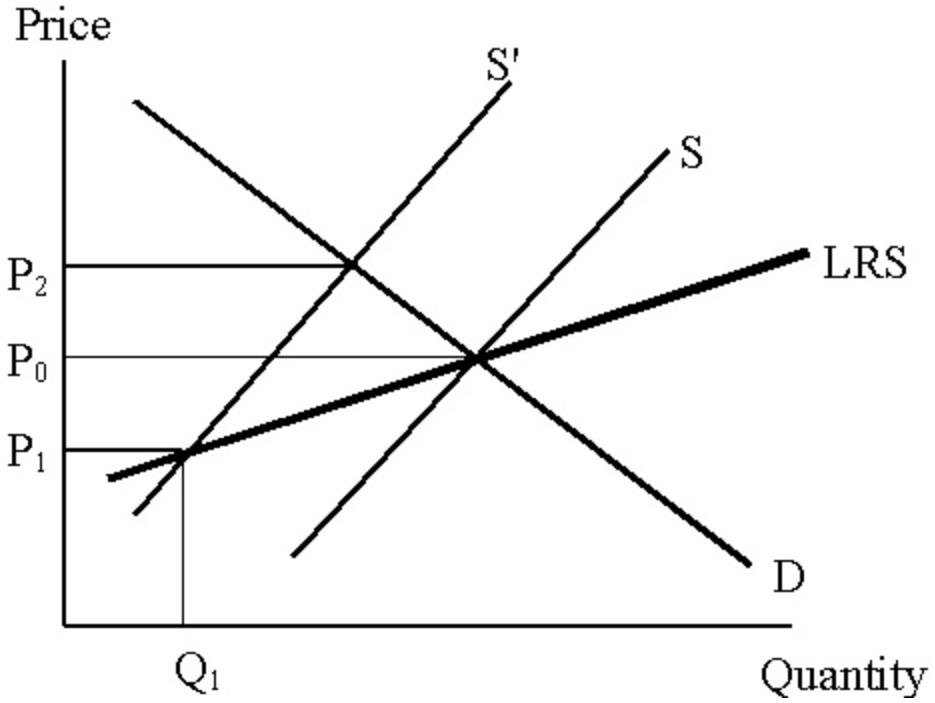
Part F: We use the equilibrium price and the industry demand curve to solve for the number of policies sold:

Demand: $Q = 1{,}000{,}000 - 5{,}000P$
At $P = \$100$, $Q = 1{,}000{,}000 - 5{,}000 \times 100 = 500{,}000$.

Part G: Since each firm produces 10,000 policies, there are 500,000 ÷ 10,000 = 50 firms in the industry.

Applications

Removing rent control:



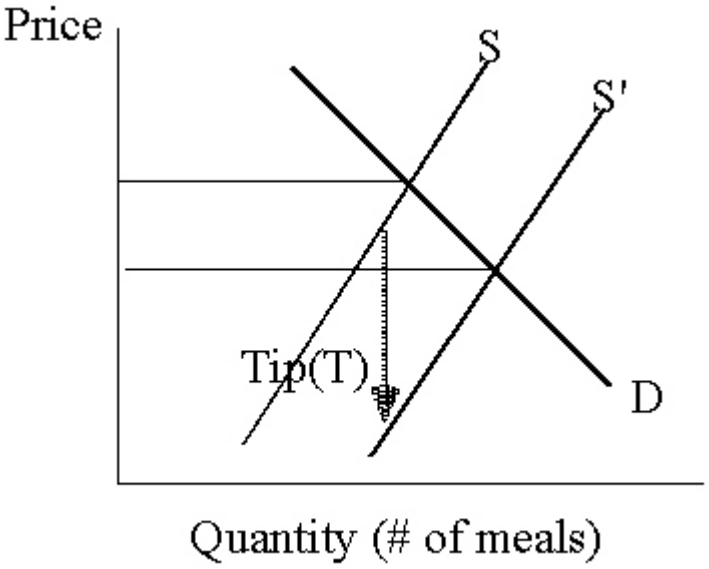
- Before rent control, the rent is P_0
- The controlled rent is P_1; in the long-run, the quantity of apartments is Q_1
- When rent control is removed, the price first moves to P_2; after the market stabilizes and more apartments are added (because the return is greater), the price moves to P_0.

Tipping busboys

The skills needed to be a busboy are widespread; this is a constant cost industry.

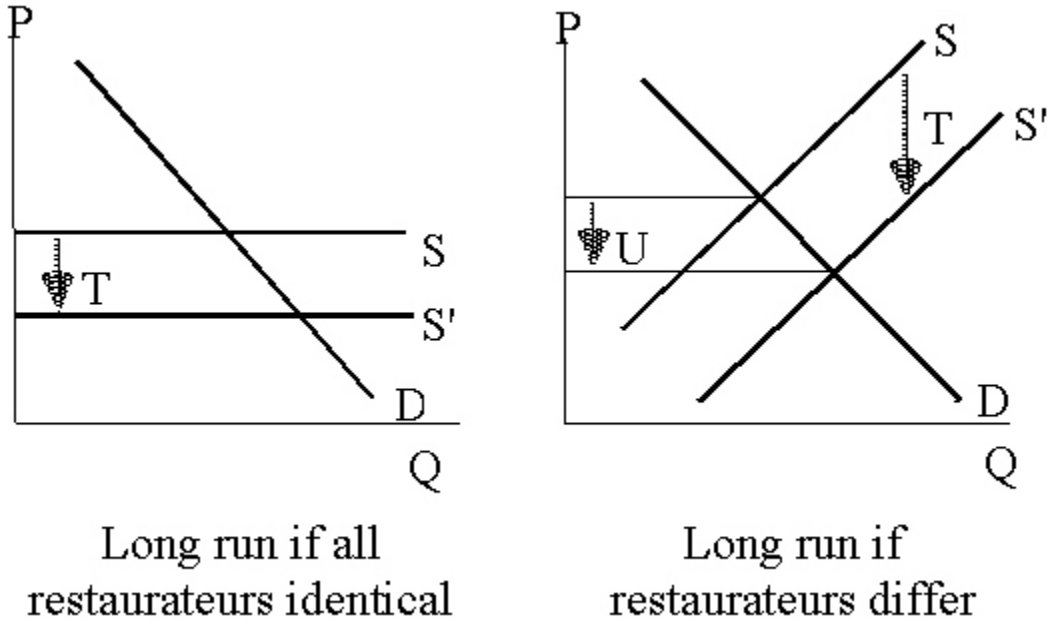
If customers tip, the supply of busboys increases, driving wages down to the previous level of compensation.

In the Short Run:



- The short run price falls by less than tip.
- Customers and the restaurant owner share the gain.

In the Long-Run:



If all restaurants are identical, the price of a restaurant visit in the long-run falls by the amount of the tip.

- If restaurants differ, entry by less efficient restaurants causes average profits to be zero without reducing price by the full amount of tip.

- The more efficient restaurants get rents of T – U per visit.
- The marginal cost falls by T, but price falls by U.
- Customers and the restaurant split the tip; the busboys get nothing.

Exercise 8.2: Long-run, Competitive, Constant-cost Equilibrium

(Adapted from question 26 of the November 2000 Course 2 exam)

In a competitive, constant cost industry, the long-run equilibrium has three identical firms each producing a quantity Q of 7 pencils at a price P of $2 per pencil. Each firm has a fixed cost of $10 and marginal cost, MC, given by:

Q	MC	Q	MC	Q	MC
7	2	10	10	13	15
8	4	11	11	14	17
9	7	12	13	15	19

Suppose the market demand schedule for pencils shifts from Q to Q′:

P	Q	Q′	P	Q	Q′
2	21	45	10	12	36
4	18	42	11	9	33
7	15	39	13	6	30

What is the new price of pencils in the short run?

Solution 8.2:

- In the long run, marginal cost (MC) is constant.
- In the short run, marginal cost (MC) increases.

In the short run, there is no entry or exit. The firms are identical, so the industry supply curve is exactly 3 times the supply curve of individual firms.

The short-run supply curve of individual firms is the MC curve:

			Supply Curve	
P	*Q*	*Q′*	*Firm*	*Industry*
2	21	45	7	21
4	18	42	8	24
7	15	39	9	27

10	12	36	10	30
11	9	33	11	33
13	6	30	12	36

At the industry equilibrium, the quantity supplied = the quantity demanded, so P = 11.