Discussion 9

Topics

- **Long-Run Average Cost Curve**
- **Economics of Scale**
- **Long-Run Equilibrium**

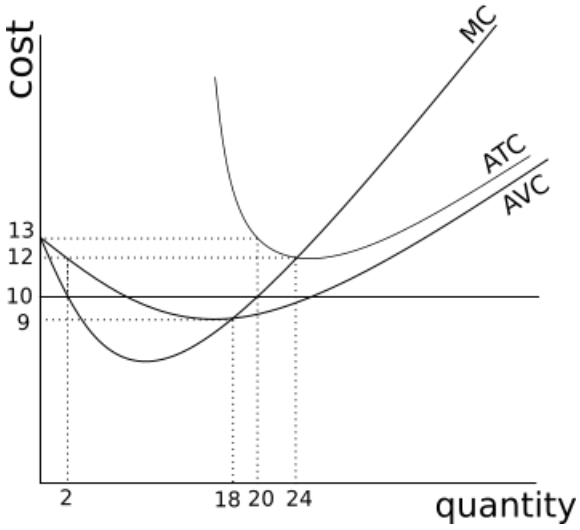
Review: Firm Behavior in Perfectly Competitive Markets in Long-Run Equilibrium

1. Be able to define short run and long run for a production process.
   - *Short run:*
     (a) *Cannot enter or exit an industry. Can choose to shut down (i.e. produce nothing).*
     (b) *There are some factors of production (i.e. some types of inputs) that cannot be changed. For example, scale of factory, rental contracts, etc.*
     (c) *Firms produce positive number of outputs when $P >$ shutdown price.*
   - *Long run:*
     (a) *Can enter or exit an industry.*
     (b) *All factors of production can be changed during long run. For example, scale of factory, rental contracts, etc.*
     (c) *Firms produce positive number of outputs and stay in the market when $P \geq$ break-even price.*
2. Define the long run average cost curve for the representative competitive firm.
   Long run average cost curve is the lower envelope of the short-run average cost curves at different scales of production.
3. Define and be able to identify economies to scale (or increasing returns to scale), diseconomies to scale (or decreasing returns to scale), and constant returns to scale.
   We need to look at the average total cost function, and check how average total cost ATC varies with output level q.
   - *If ATC increases, when q inreases, we call it "diseconomies of scale."*
   - *If ATC decreases, when q inreases, we call it "economies of scale."*

- *If ATC does not change, when q inreases, we call it "constant returns to scale."*
- *The minimum output level of ATC is called the Minimum Efficient Scale of the firm.*

Exercises

Exercise 1 (Cost Curves and Equilibrium) The graph below represents the cost structure for a firm that is in a perfectly competitive industry and a scale of production such that long run average costs are minimized:



1. What is the minimum price such that this firm will produce in the short-run?

2. What is the minimum price such that this firm will produce in the long-run?

3. Suppose the total market demand in this industry is given by $Q = 1000 - 20P$. What is the long-run equilibrium price, number of firms, and units supplied by each firm? (Assume the number of firms has to be an integer)

Exercise 2 (Equilibrium in Taco Market) Joe is one of many people in Madison who owns and operates a taco stand. Currently he and everyone else in town are offering essentially the same combinations of meat, cheese, guacamole and tortillas, and you really can't taste the difference between two different taco stands. Joe faces a variable cost of making tacos of $VC = 10q + 1/2q^2$, which gives him a $MC = 10 + q$. He has no fixed costs. All other stands have the same costs as Joe.

1. What is Joe's average total cost? Does Joe have economies of scale for tacos?

2. Suppose the given market price is \$28 (these are really good tacos). What quantity does Joe supply at this price?

3. If market demand is given by $Q_D = 500 - 5P$, how many tacos are sold in total? How many taco stands must be operating? What is the market supply curve?

4. What is Joe's profit? Could this be a long run equilibrium in this perfectly competitive environment with free entry and exit?

Exercise 3 (Plastic charis and Market Equilibrium) The market for plastic chairs in Madison is perfectly competitive. The market demand for plastic chairs is given as $P = 130 - Q$. The market supply for plastic chairs is given as $P = 2 + Q$. Each firm faces the cost functions $TC = 4q^2 + 2q + 64$ and $MC = 8q + 2$.

1. Determine the equilibrium quantity and price for this plastic chair market.

2. What are the break-even price for long-run and shut-down price for a representative firm in the short-run?

3. At the current equilibrium price, what is the quantity of chairs provided by a representative firm? Calculate a representative firm's profit.

4. How many firms are in the market in the short-run?

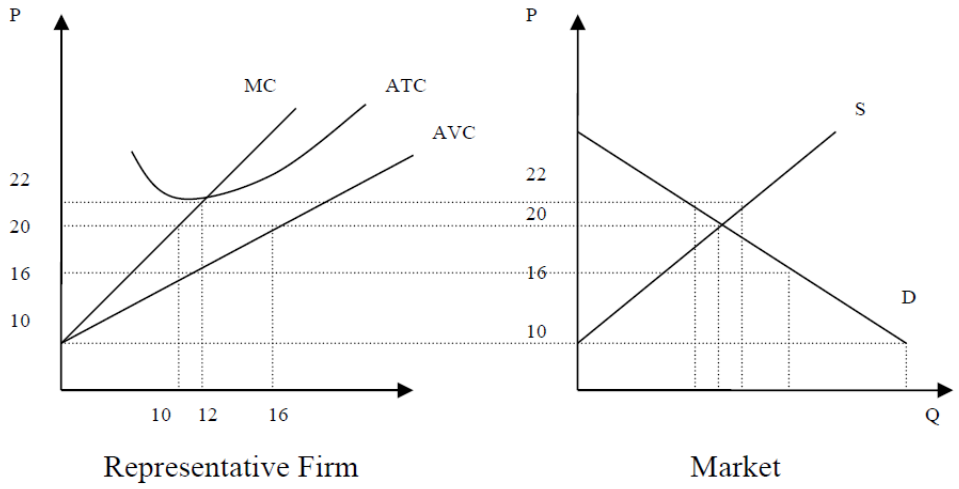
5. What is the long-run equilibrium price in the market? What is the long-run profit maximizing level of output for a representative firm? What is the long-run profit?

6. How many firms are in the market in the long run?

Multiple Choice Questions

Exercise 4 Use the following information to answer the next two questions.

Use the figures below to answer the next two questions:



1. What is the current market price and the industry's long-run equilibrium price? Is the industry currently in long-run equilibrium?
   (a) $20, $22. Yes.
   (b) $16,$16. Yes
   (c) $16,$22. No
   (d) $20,$22. No

2. Which of the following statements is correct?
   (a) Decrease or increase in consumer demand only changes the short-run equilibrium price, but not the long-run equilibrium price.
   (b) In the long run, the total quantity supplied will decrease.
   (c) In the long run, the quantity supplied by each supplier will increase.
   (d) All of the above.

Exercise 5 If profits are negative in the short-run in a perfectly competitive industry, which of the following would you *not* expect to happen as the market moves to the long run (assuming no external economies or external diseconomies of scale)?

(a) The market price will increase.

(b) Firms will exit the market.

(c) Total market output will fall.

(d) The demand curve faced by an individual firm (MR) will shift down.

Exercise 6 Suppose an industry currently has 10 identical firms. Assume their current scale of production is such that long run average costs are minimized. Their individual cost functions are:

$$\text{ATC} = \frac{100}{q} + q$$
$$\text{MC} = 2q.$$

1. Given the information above, which of the following statements is correct?

   (a) The shutdown price is 0.

   (b) The breakeven price is \$20.

   (c) The long-run equilibrium price is \$20.

   (d) All of the above.

2. Market demand is given by $Q_D = 2000 - 15P$. Which of the following statements is correct?

   (a) In the long run, some firms will exit.

   (b) In the long run, total quantity supplied will increase.

   (c) The industry is currently in long-run equilibrium.

   (d) None of the above.

Exercise 7 Consider the market for headphones, which has many identical firms. Each competitive firm in this industry has cost functions as follows:

$$TC = 3q^2 + 4q + 48$$
$$MC = 6q + 4,$$

where quantity is in hundreds of thousands.

Assume that the current scale of production is such that long run average costs are minimized. The demand for tablets is given by

$$P = 88 - Q.$$

1. What is the long-run price?
   (a) \$26
   (b) \$27
   (c) \$28
   (d) \$29
2. In the long run, how many firms are there?
   (a) 12
   (b) 13
   (c) 14
   (d) 15

Exercise 8 Assume a perfectly competitive industry is in long-run equilibrium, then the property taxes for firm increase

1. In the short run we expect that output levels:
   (a) decrease for the firms and increase for the industry.
   (b) decrease for the firms and decrease for the industry.
   (c) remain unchanged for both the firms and the industry.
   (d) increase for the firms and increase for the industry.
   (e) increase for the firms and decrease for the industry.

2. The profits earned in the short run by firms after the property tax increase will:
   (a) be identical to those earned before the increase since they still produce where P=MC.
   (b) be slightly higher as firms increase price.
   (c) be negative since production costs rose but price did not.
   (d) be zero since price and cost will rise exactly the same amount.
   (e) still be greater than zero, but slightly lower than before.increase for the firms and decrease for the industry.

3. Over time the industry will adjust to a new long-run equilibrium. The new equilibrium will differ from the old in that:
   (a) There will be fewer firms and market price will be higher.
   (b) There will be fewer firms but market price will be the same.
   (c) There will be fewer firms and market price will be lower.
   (d) There will be more firms and market price will be higher.
   (e) There will be more firms but market price will be the same.