CHAPTER
12

Perfect Competition and the Supply Curve

1. For each of the following, is the business a price-taking producer? Explain your answers.

a. A cappuccino café in a university town where there are dozens of very similar cappuccino cafés

b. The makers of Pepsi-Cola

c. One of many sellers of zucchini at a local farmers' market

Solution

1. **a.** The cappuccino café is probably a price-taking producer, especially if there are a large number of cafés in town, since each will have a small market share and each produces a standardized product.

b. There is only one manufacturer of Pepsi-Cola, and it works hard to differentiate its product from others in the minds of consumers. It is not a price-taking producer.

c. Zucchini sellers at the farmers' market are price-taking producers; there are many of them, none of whom can affect the market price for zucchini, which is a standardized product.

2. For each of the following, is the industry perfectly competitive? Referring to market share, standardization of the product, and/or free entry and exit, explain your answers.

a. Aspirin

b. Alicia Keys concerts

c. SUVs

Solution

2. **a.** Yes, aspirin is produced in a perfectly competitive industry. Many manufacturers produce aspirin, the product is standardized, and new manufacturers can easily enter and existing manufacturers can easily exit the industry.

b. No, Alicia Keys concerts are not produced in a perfectly competitive industry. There is not free entry into the industry—there is only one Alicia Keys.

c. No, SUVs are not produced in a perfectly competitive industry. There are only a few manufacturers of SUVs, each holding a large market share, and SUVs are not a standardized product in the minds of consumers.

3. Bob produces Blu-ray movies for sale, which requires a building and a machine that copies the original movie onto a Blu-ray. Bob rents a building for $30,000 per month and rents a machine for $20,000 a month. Those are his fixed costs. His variable cost per month is given in the accompanying table.

Quantity of Blu-rays	*VC*
0	$0
1,000	5,000
2,000	8,000
3,000	9,000
4,000	14,000
5,000	20,000
6,000	33,000
7,000	49,000
8,000	72,000
9,000	99,000
10,000	150,000

a. Calculate Bob's average variable cost, average total cost, and marginal cost for each quantity of output.

b. There is free entry into the industry, and anyone who enters will face the same costs as Bob. Suppose that currently the price of a Blu-ray is $25. What will Bob's profit be? Is this a long-run equilibrium? If not, what will the price of Blu-ray movies be in the long run?

Solution

3. **a.** Bob's average variable cost, average total cost, and marginal cost are shown in the accompanying table.

Quantity of Blu-rays	*VC*	*MC* of Blu-ray	*AVC* of Blu-ray	*ATC* of Blu-ray
0	$0.00		—	—
		$5.00		
1,000	5,000.00		$5.00	$55.00
		3.00		
2,000	8,000.00		4.00	29.00
		1.00		
3,000	9,000.00		3.00	19.67
		5.00		
4,000	14,000.00		3.50	16.00
		6.00		
5,000	20,000.00		4.00	14.00
		13.00		
6,000	33,000.00		5.50	13.83
		16.00		
7,000	49,000.00		7.00	14.14
		23.00		
8,000	72,000.00		9.00	15.25
		27.00		
9,000	99,000.00		11.00	16.56
		51.00		
10,000	150,000.00		15.00	20.00

b. At a price of \$25, $P = MC$ at a quantity of 8,000, and ATC = \$15.25. Bob makes a profit of \$25 – \$15.25 = \$9.75 per Blu-ray, for a total profit of 8,000 × \$9.75 = \$78,000. If there is free entry into the industry, this profit will attract new firms. As firms enter, the price of Blu-rays will eventually fall until it is equal to the minimum average total cost. Here, the average total cost reaches its minimum of \$13.83 at 6,000 Blu-rays per month. So the long-run price of Blu-rays will be \$13.83.

4. Consider Bob's Blu-ray company described in Problem 4. Assume that Blu-ray production is a perfectly competitive industry. For each of the following questions, explain your answers.

a. What is Bob's break-even price? What is his shut-down price?

b. Suppose the price of a Blu-ray is \$2. What should Bob do in the short run?

c. Suppose the price of a Blu-ray is \$7. What is the profit-maximizing quantity of Blu-rays that Bob should produce? What will his total profit be? Will he produce or shut down in the short run? Will he stay in the industry or exit in the long run?

d. Suppose instead that the price of Blu-rays is \$20. Now what is the profit-maximizing quantity of Blu-rays that Bob should produce? What will his total profit be now? Will he produce or shut down in the short run? Will he stay in the industry or exit in the long run?

Solution

4. a. Bob's break-even price is \$13.83 because this is the minimum average total cost. His shut-down price is \$3, the minimum average variable cost, because below that price his revenue does not even cover his variable cost.

b. If the price of Blu-rays is \$2, the price is below Bob's shut-down price of \$3. So Bob should shut down in the short run.

c. If Blu-rays sell for \$7, Bob should produce 5,000 Blu-rays because for any greater quantity his marginal cost exceeds his marginal revenue (the market price). His total profit will be –\$35,000, a loss of \$35,000, since he loses \$7(price) – \$14 *(ATC)* = \$7 per Blu-ray produced. In the short run, he will produce because his short-run loss if he were to shut down would be greater; it would equal his fixed costs of \$50,000. In the long run, he will exit the industry because his profit is negative: the price of \$7 per Blu-ray is below his break-even price of \$13.83.

d. If Blu-rays sell instead for \$20, Bob should produce 7,000 Blu-rays because at this quantity his marginal cost approximately equals his marginal revenue (the market price). His profit per Blu-ray is \$20 (price) – \$14.14(*ATC*) = \$5.86, giving him a total profit of 7,000 × \$5.86 = \$41,020. In the short run, he will produce because he is covering his variable cost (the price is above the shut-down price). In the long run, he will stay in the industry because his profit is not negative (the price is above the break-even price).

5. Consider again Bob's Blu-ray company described in Problem 4.

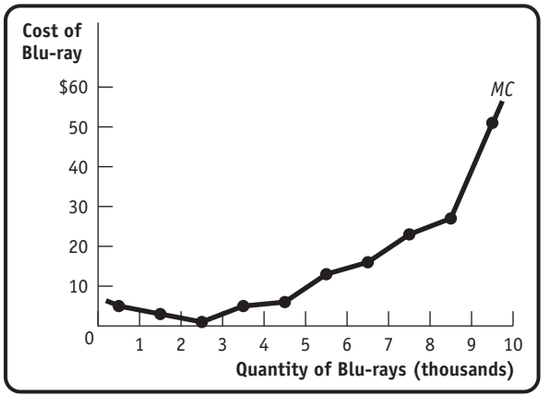
a. Draw Bob's marginal cost curve.

b. Over what range of prices will Bob produce no Blu-rays in the short run?

c. Draw Bob's individual supply curve. In your graph, plot the price range from \$0 to \$60 in increments of \$10.

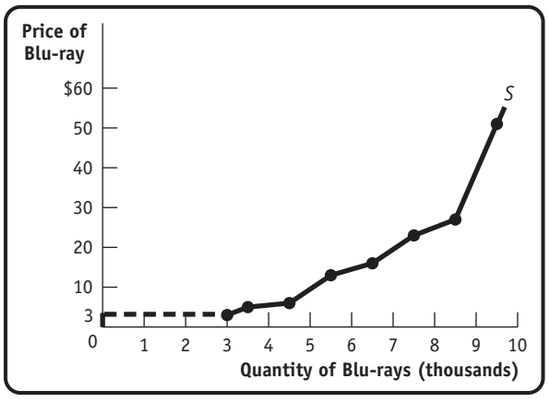
Solution

5. **a.** Bob's marginal cost curve is shown in the accompanying diagram.



b. Bob will produce no Blu-rays if the price falls below $3 because $3 is the lowest point on the average variable cost curve—his shut-down price.

c. The individual supply curve is shown in the accompanying diagram. It is his *MC* curve above the minimum average variable cost. At a price below $3, output is 0, shown by the solid vertical line at the origin.



6. **a.** A profit-maximizing business incurs an economic loss of $10,000 per year. Its fixed cost is $15,000 per year. Should it produce or shut down in the short run? Should it stay in the industry or exit in the long run?

b. Suppose instead that this business has a fixed cost of $6,000 per year. Should it produce or shut down in the short run? Should it stay in the industry or exit in the long run?

Solution

6. **a.** In the short run, the business should produce. If it shuts down, the short-run annual loss will be $15,000, its fixed cost; but if it produces, the loss will be only $10,000. So the business minimizes its short-run loss by producing. In the long run, the business should exit the industry because it is incurring a loss.

b. In the short run, the business should shut down. If it shuts down, the short-run loss will be $6,000, its fixed cost; if it continues to produce, the loss will be $10,000. So the business minimizes its short-run loss by shutting down. In the long run, the firm should exit the industry because it is incurring a loss.

7. The first sushi restaurant opens in town. Initially people are very cautious about eating tiny portions of raw fish, as this is a town where large portions of grilled meat have always been popular. Soon, however, an influential health report warns consumers against grilled meat and suggests that they increase their consumption of fish, especially raw fish. The sushi restaurant becomes very popular and its profit increases.

a. What will happen to the short-run profit of the sushi restaurant? What will happen to the number of sushi restaurants in town in the long run? Will the first sushi restaurant be able to sustain its short-run profit over the long run? Explain your answers.

b. Local steakhouses suffer from the popularity of sushi and start incurring losses. What will happen to the number of steakhouses in town in the long run? Explain your answer.

Solution

7. **a.** The short-run profit of the sushi restaurant will rise, inducing others to open sushi restaurants. The number of sushi restaurants in town will increase. Over time, as the supply of sushi restaurants increases, the equilibrium price of sushi will decrease, lowering the short-run profit of the original sushi restaurant.

b. The number of steakhouses in town will decrease in the long run, as owners incur losses and exit from the industry.

8. A perfectly competitive firm has the following short-run total cost:

Quantity	*TC*
0	$5
1	10
2	13
3	18
4	25
5	34
6	45

Market demand for the firm's product is given by the following market demand schedule:

Price	Quantity demanded
$12	300
10	500
8	800
6	1,200
4	1,800

a. Calculate this firm's marginal cost and, for all output levels except zero, the firm's average variable cost and average total cost.

b. There are 100 firms in this industry that all have costs identical to those of this firm. Draw the short-run industry supply curve. In the same diagram, draw the market demand curve.

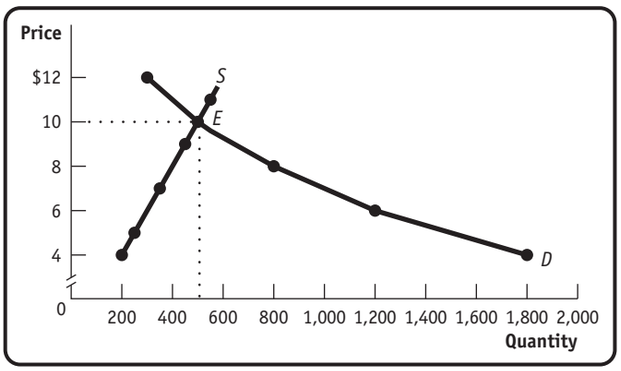
c. What is the market price, and how much profit will each firm make?

Solution

8. **a.** This firm's fixed cost is \$5, since even when the firm produces no output, it incurs a total cost of \$5. The marginal cost (*MC*), average variable cost (*AVC*), and average total cost (*ATC*) are given in the accompanying table.

Quantity	*TC*	*MC*	*AVC*	*ATC*
0	\$5.00		—	—
		\$5.00		
1	10.00		\$5.00	\$10.00
		3.00		
2	13.00		4.00	6.50
		5.00		
3	18.00		4.33	6.00
		7.00		
4	25.00		5.00	6.25
		9.00		
5	34.00		5.80	6.80
		11.00		
6	45.00		6.67	7.50

b. This firm's minimum average variable cost is \$4 at 2 units of output. So the firm will produce only if the price is greater than \$4, making its individual supply curve the same as its marginal cost curve above the shut-down price of \$4. The same is true for all other firms in the industry. That is, if the price is \$4, the quantity supplied by all 100 firms is 200. The quantity supplied by all 100 firms at a price of \$6 is 300, and so on. The accompanying diagram illustrates this principle.



c. The quantity supplied equals the quantity demanded at a price of \$10—the (short-run) market equilibrium price. So the quantity bought and sold in this market is 500 units. Each firm will maximize profit by producing 5 units of output—the greatest quantity at which price equals or exceeds marginal cost. At 5 units of output, each firm's revenue is \$10 × 5 = \$50. Its total cost is \$34. So it makes a profit of \$16.

9. A new vaccine against a deadly disease has just been discovered. Presently, 55 people die from the disease each year. The new vaccine will save lives, but it is not completely safe. Some recipients of the shots will die from adverse reactions. The projected effects of the inoculation are given in the accompanying table:

Percent of population inoculated	Total deaths due to disease	Total deaths due to inoculation	Marginal benefit of inoculation	Marginal cost of inoculation	"Profit" of inoculation
0	55	0			
10	45	0			
20	36	1			
30	28	3			
40	21	6			
50	15	10			
60	10	15			
70	6	20			
80	3	25			
90	1	30			
100	0	35			

a. What are the interpretations of "marginal benefit" and "marginal cost" here? Calculate marginal benefit and marginal cost per each 10% increase in the rate of inoculation. Write your answers in the table.

b. What proportion of the population should optimally be inoculated?

c. What is the interpretation of "profit" here? Calculate the profit for all levels of inoculation.

9. **a.** The "marginal benefit" is the additional lives saved due to inoculation. The "marginal cost" is the additional deaths due to inoculation. The values are given in the accompanying table.

Percent of population inoculated	Total deaths due to disease	Total deaths due to inoculation	Marginal benefit of inoculation	Marginal cost of inoculation	"Profit" of inoculation
0	55	0			0
10	45	0	10	0	10 − 0 = 10
20	36	1	9	1	19 − 1 = 18
30	28	3	8	2	27 − 3 = 24
40	21	6	7	3	34 − 6 = 28
50	15	10	6	4	40 − 10 = 30
60	10	15	5	5	45 − 15 = 30
70	6	20	4	5	49 − 20 = 29
80	3	25	3	5	52 − 25 = 27
90	1	30	2	5	54 − 30 = 24
100	0	35	1	5	55 − 35 = 20

b. People should be inoculated until the marginal cost equals the marginal benefit from the inoculations. This occurs when $MB = MC = 5$, at which point 50% or 60% of the population should be inoculated (both result in the greatest number of lives saved).

c. "Profit" is total lives saved minus total lives lost. The profit at each level of inoculation in the population is shown in the table. The maximum number of lives saved is 30, which occurs at inoculation levels of both 50% and 60%.

10. Evaluate each of the following statements. If a statement is true, explain why; if it is false, identify the mistake and try to correct it.

a. A profit-maximizing firm in a perfectly competitive industry should select the output level at which the difference between the market price and marginal cost is greatest.

b. An increase in fixed cost lowers the profit-maximizing quantity of output produced in the short run.

Solution

10. **a.** False. For a profit-maximizing firm in a perfectly competitive industry, profit is maximized by producing a quantity at which marginal cost is equal to the market price.

b. False. Changes in fixed cost do not affect marginal cost and so do not change the profit-maximizing quantity of output produced. Changes in fixed cost do, however, change the amount of profit earned and the firm's break-even price: the higher the fixed cost, the higher the firm's break-even price and the lower its profit.

11. The production of agricultural products like wheat is one of the few examples of a perfectly competitive industry. In this question, we analyze results from a study released by the U.S. Department of Agriculture about wheat production in the United States back in 2013.

a. The average variable cost per acre planted with wheat was $127 per acre. Assuming a yield of 44 bushels per acre, calculate the average variable cost per bushel of wheat.

b. The average price of wheat received by a farmer in 2013 was $7.58 per bushel. Do you think the average farm would have exited the industry in the short run? Explain.

c. With a yield of 44 bushels of wheat per acre, the average total cost per farm was $4.80 per bushel. The harvested acreage for rye (a type of wheat) in the United States increased from 242,000 in 2010 to 306,000 in 2013. Using the information on prices and costs here and in parts a and b, explain why this might have happened.

d. Using the above information, do you think the prices of wheat were higher or lower prior to 1998? Why?

Solution

11. **a.** Since the yield is 44 bushels per acre, we know that producing 44 bushels of wheat is associated with an average variable cost of $127. So the production of 1 bushel of wheat is associated with an average variable cost of $127/44 bushels = $2.89 per bushel.

b. We would not expect the average farm to have exited the industry in the short run because the price it received for wheat, $7.58 per bushel, was greater than the average variable cost of production, $2.89 per bushel.

c. Because wheat production increased over the period, we would expect the price in 2010 to be greater than $4.80. The average farm would increase wheat production and more farms would have entered the industry in the long run because the price it received per bushel was greater than the average total cost of production.

The farm was reaping an economic profit by operating. So the increase in the harvested acreage of wheat should have been expected after 2010. Indeed, the price of wheat in 2010 was $5.80 per bushel.

d. Assuming the cost of wheat production remains relatively constant, with current prices greater than the average cost of production, we would expect more farmers to enter the wheat market and existing farmers to increase their acreage of planted wheat. We should see the amount of harvested wheat increase.

12. The accompanying table presents prices for washing and ironing a man's shirt taken from a survey of California dry cleaners.

Dry Cleaner	City	Price
A-1 Cleaners	Santa Barbara	$1.50
Regal Cleaners	Santa Barbara	1.95
St. Paul Cleaners	Santa Barbara	1.95
Zip Kleen Dry Cleaners	Santa Barbara	1.95
Effie the Tailor	Santa Barbara	2.00
Magnolia Too	Goleta	2.00
Master Cleaners	Santa Barbara	2.00
Santa Barbara Cleaners	Goleta	2.00
Sunny Cleaners	Santa Barbara	2.00
Casitas Cleaners	Carpinteria	2.10
Rockwell Cleaners	Carpinteria	2.10
Norvelle Bass Cleaners	Santa Barbara	2.15
Ablitt's Fine Cleaners	Santa Barbara	2.25
California Cleaners	Goleta	2.25
Justo the Tailor	Santa Barbara	2.25
Pressed 4 Time	Goleta	2.50
King's Cleaners	Goleta	2.50

a. What is the average price per shirt washed and ironed in Goleta? In Santa Barbara?

b. Draw typical marginal cost and average total cost curves for California Cleaners in Goleta, assuming it is a perfectly competitive firm but is making a profit on each shirt in the short run. Mark the short-run equilibrium point and shade the area that corresponds to the profit made by the dry cleaner.

c. Assume $2.25 is the short-run equilibrium price in Goleta. Draw a typical short-run demand and supply curve for the market. Label the equilibrium point.

d. Observing profits in the Goleta area, another dry cleaning service, Diamond Cleaners, enters the market. It charges $1.95 per shirt. What is the new average price of washing and ironing a shirt in Goleta? Illustrate the effect of entry on the average Goleta price by a shift of the short-run supply curve, the demand curve, or both.

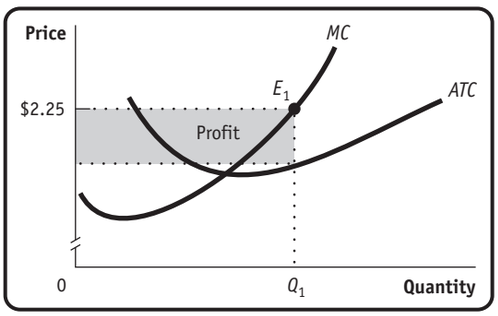
e. Assume that California Cleaners now charges the new average price and just breaks even (that is, makes zero economic profit) at this price. Show the likely effect of the entry on your diagram in part b.

f. If the dry cleaning industry is perfectly competitive, what does the average difference in price between Goleta and Santa Barbara imply about costs in the two areas?

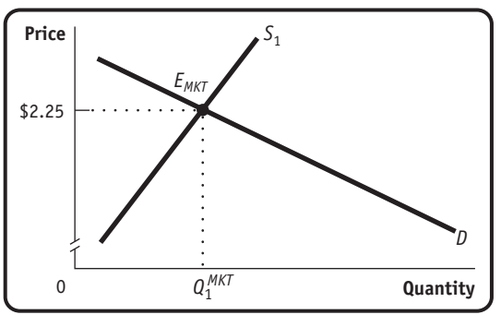
Solution

12. **a.** The average price per shirt washed and ironed, the sum of prices charged by each cleaner in that town divided by the number of cleaners in that town, is $2.25 in Goleta and $2.00 in Santa Barbara.

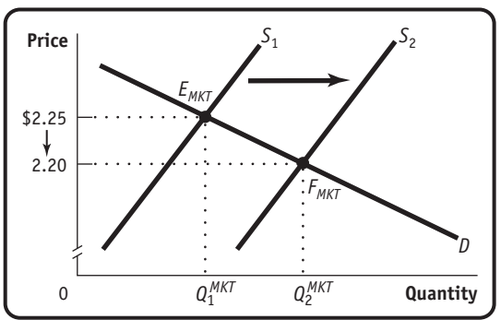
b. The marginal cost curve (*MC*) cuts through the average total cost curve (*ATC*) at the lowest point of the *ATC* curve. Since California Cleaners is making a profit, price has to be above the break-even price (the minimum average total cost). Given this, California Cleaners maximizes its profit (shown by the shaded area) by producing quantity Q_1 in the accompanying diagram—the quantity at which its marginal cost equals the market price.



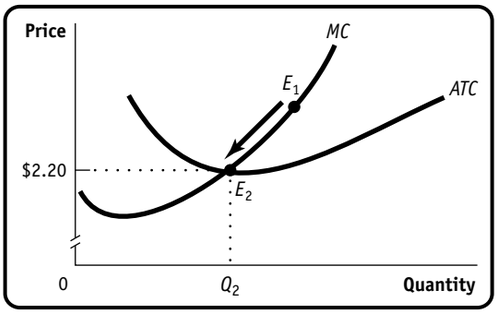
c. The accompanying diagram shows the short-run market supply curve and the market demand curve.



d. The entry of a new firm increases the quantity supplied at each price and shifts the supply curve to the right, as indicated by the move from S_1 to S_2 in the accompanying diagram. So the new equilibrium corresponds to a lower equilibrium price, $2.20, and a higher equilibrium quantity.



e. Since California Cleaners breaks even at $2.20 a shirt, it must be operating at the minimum of its average total cost curve. The likely effect on the diagram in part b is shown below.



f. Since, in the long run, firms break even in a perfectly competitive industry, costs have to be higher in Goleta than in Santa Barbara.

13. Kate's Katering provides catered meals, and the catered meals industry is perfectly competitive. Kate's machinery costs $100 per day and is the only fixed input. Her variable cost consists of the wages paid to the cooks and the food ingredients. The variable cost per day associated with each level of output is given in the accompanying table.

WORK IT OUT

Interactive, step-by-step help solving this problem is available to your students via LaunchPad

Quantity of meals	*VC*
0	$0
10	200
20	300
30	480
40	700
50	1,000

a. Calculate the total cost, the average variable cost, the average total cost, and the marginal cost for each quantity of output.

b. What is the break-even price and quantity? What is the shut-down price and quantity?

c. Suppose that the price at which Kate can sell catered meals is $21 per meal. In the short run, will Kate earn a profit? In the short run, should she produce or shut down?

d. Suppose that the price at which Kate can sell catered meals is $17 per meal. In the short run, will Kate earn a profit? In the short run, should she produce or shut down?

e. Suppose that the price at which Kate can sell catered meals is $13 per meal. In the short run, will Kate earn a profit? In the short run, should she produce or shut down?

Solution

13. a. From Kate's variable cost (*VC*), the accompanying table calculates Kate's total cost (*TC*), average variable cost (*AVC*), average total cost (*ATC*), and marginal cost (*MC*).

Quantity of meals	*VC*	*TC*	*MC* of meal	*AVC* of meal	*ATC* of meal
0	$0.00	$100.00		—	—
			$20.00		
10	200.00	300.00		$20.00	$30.00
			10.00		
20	300.00	400.00		15.00	20.00
			18.00		
30	480.00	580.00		16.00	19.33
			22.00		
40	700.00	800.00		17.50	20.00
			30.00		
50	1,000.00	1,100.00		20.00	22.00

b. Kate's break-even price, the minimum average total cost, is $19.33, at an output quantity of 30 meals. Kate's shut-down price, the minimum average variable cost, is $15, at an output of 20 meals.

c. When the price is $21, Kate will make a profit: the price is above her break-even price. And since the price is above her shut-down price, Kate should produce in the short run, not shut down.

d. When the price is $17, Kate will incur a loss: the price is below her break-even price. But since the price is above her shut-down price, Kate should produce in the short run, not shut down.

e. When the price is $13, Kate would incur a loss if she were to produce: the price is below her break-even price. And since the price is also below her shut-down price, Kate should shut down in the short run.