SOLUTIONS TO TEXT PROBLEMS:

Quick Quizzes

1. When a competitive firm doubles the amount it sells, the price remains the same, so its total revenue doubles.

2. The price faced by a profit-maximizing firm is equal to its marginal cost because if price were above marginal cost, the firm could increase profits by increasing output, while if price were below marginal cost, the firm could increase profits by decreasing output.

   A profit-maximizing firm decides to shut down in the short run when price is less than average variable cost. In the long run, a firm will exit a market when price is less than average total cost.

3. In the long run, with free entry and exit, the price in the market is equal to both a firm's marginal cost and its average total cost, as Figure 1 shows. The firm chooses its quantity so that marginal cost equals price; doing so ensures that the firm is maximizing its profit. In the long run, entry into and exit from the industry drive the price of the good to the minimum point on the average-total-cost curve.

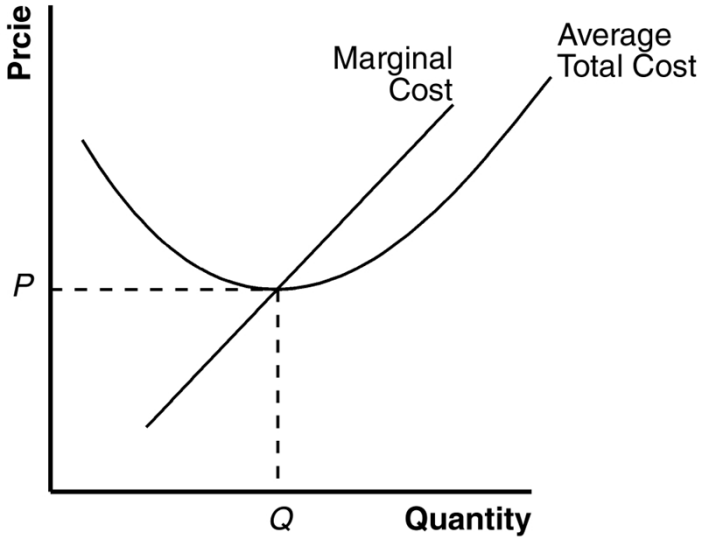

Figure 1

Questions for Review

1. A competitive firm is a firm in a market in which: (1) there are many buyers and many sellers in the market; (2) the goods offered by the various sellers are largely the same; and (3) usually firms can freely enter or exit the market.

2. Figure 2 shows the cost curves for a typical firm. For a given price (such as P^*), the level of output that maximizes profit is the output where marginal cost equals price (Q^*), as long as price is greater than average variable cost at that point (in the short run), or greater than average total cost (in the long run).

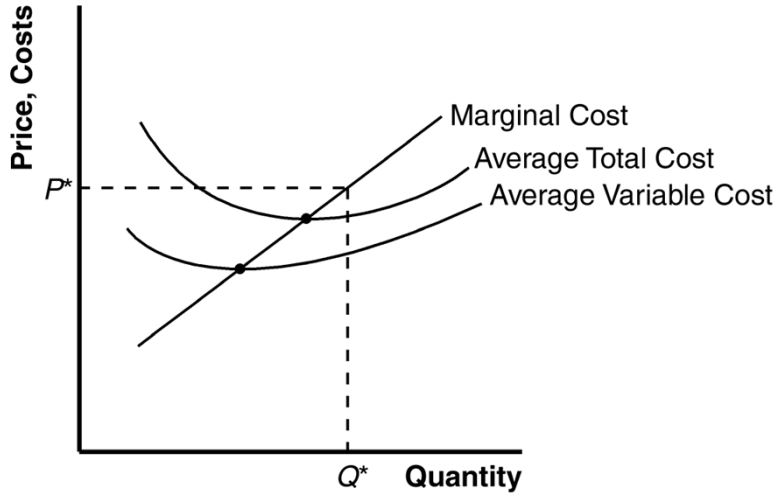

Figure 2

3. A firm will shut down temporarily if the revenue it would get from producing is less than the variable costs of production. This occurs if price is less than average variable cost.

4. A firm will exit a market if the revenue it would get if it stayed in business is less than its total cost. This occurs if price is less than average total cost.

5. A firm's price equals marginal cost in both the short run and the long run. In both the short run and the long run, price equals marginal revenue. The firm should increase output as long as marginal revenue exceeds marginal cost, and reduce output if marginal revenue is less than marginal cost. Profits are maximized when marginal revenue equals marginal cost.

6. The firm's price equals the minimum of average total cost only in the long run. In the short run, price may be greater than average total cost, in which case the firm is making profits, or price may be less than average total cost, in which case the firm is making losses. But the situation is different in the long run. If firms are making profits, other firms will enter the industry, which will lower the price of the good. If firms are making losses, they will exit the industry, which will raise the price of the good. Entry or exit continues until firms are making neither profits nor losses. At that point, price equals average total cost.

7. Market supply curves are typically more elastic in the long run than in the short run. In a competitive market, since entry or exit occurs until price equals the minimum of average total cost, the supply curve is perfectly elastic in the long run.

Problems and Applications

1. A competitive market is one in which: (1) there are many buyers and many sellers in the market; (2) the goods offered by the various sellers are largely the same; and (3) usually firms can freely enter or exit the market. Of these goods, bottled water is probably the closest to a competitive market. Tap water is a natural monopoly because there's only one seller. Cola and beer are not perfectly competitive because every brand is slightly different.

2. Since a new customer is offering to pay $300 for one dose, marginal revenue between 200 and 201 doses is $300. So we must find out if marginal cost is greater than or less than $300. To do this, calculate total cost for 200 doses and 201 doses, and calculate the increase in total cost.

Multiplying quantity by average total cost, we find that total cost rises from $40,000 to $40,401, so marginal cost is $401. So your roommate should not make the additional dose.

3. a. Remembering that price equals marginal cost when firms are maximizing profit, we know the marginal cost must be 30 cents, since that is the price.

   b. The industry is not in long-run equilibrium since price exceeds average total cost.

4. Once you have ordered the dinner, its cost is sunk, so it does not represent an opportunity cost. As a result, the cost of the dinner should not influence your decision about stuffing yourself.

5. Since Bob's average total cost is $280/10 = $28, which is greater than the price, he will exit the industry in the long run. Since fixed cost is $30, average variable cost is ($280 - $30)/10 = $25, which is less than price, so Bob won't shut down in the short run.

6. Here's the table showing costs, revenues, and profits:

Quantity	Total Cost	Marginal Cost	Total Revenue	Marginal Revenue	Profit
0	$ 8	---	$ 0	---	$ -8
1	9	$ 1	8	$ 8	-1
2	10	1	16	8	6
3	11	1	24	8	13
4	13	2	32	8	19
5	19	6	40	8	21
6	27	8	48	8	21
7	37	10	56	8	19

   a. The firm should produce 5 or 6 units to maximize profit.

   b. Marginal revenue and marginal cost are graphed in Figure 3. The curves cross at a quantity between 5 and 6 units, yielding the same answer as in part (a).

   c. This industry is competitive since marginal revenue is the same for each quantity. The industry is not in long-run equilibrium, since profit is positive.

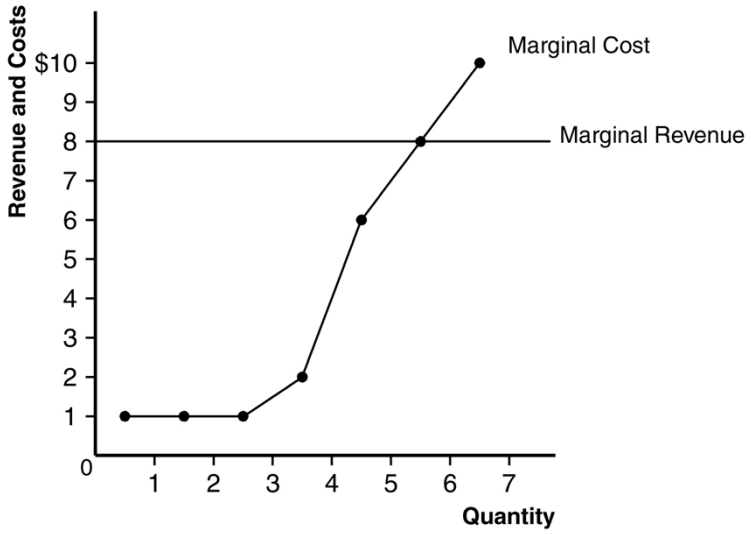

Figure 3

7. a. Figure 4 shows the short-run effect of declining demand for beef. The shift of the industry demand curve from D_1 to D_2 reduces the quantity from Q_1 to Q_2 and reduces the price from P_1 to P_2. This affects the firm, reducing its quantity from q_1 to q_2. Before the decline in the price, the firm was making zero profits; afterwards, profits are negative, as average total cost exceeds price.

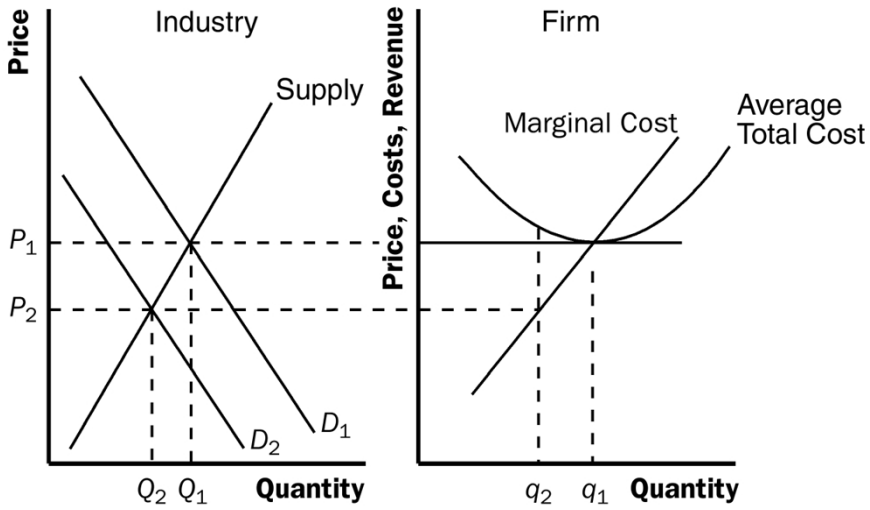

Figure 4

b. Figure 5 shows the long-run effect of declining demand for beef. Since firms were losing money in the short run, some firms leave the industry. This shifts the supply curve from S_1 to S_3. The shift of the supply curve is just enough to increase the price back to its original level, P_1. As a result, industry output falls still further, to Q_3. For firms that remain in the industry, the rise in the price to P_1 returns them to their original situation, producing quantity q_1 and earning zero profits.

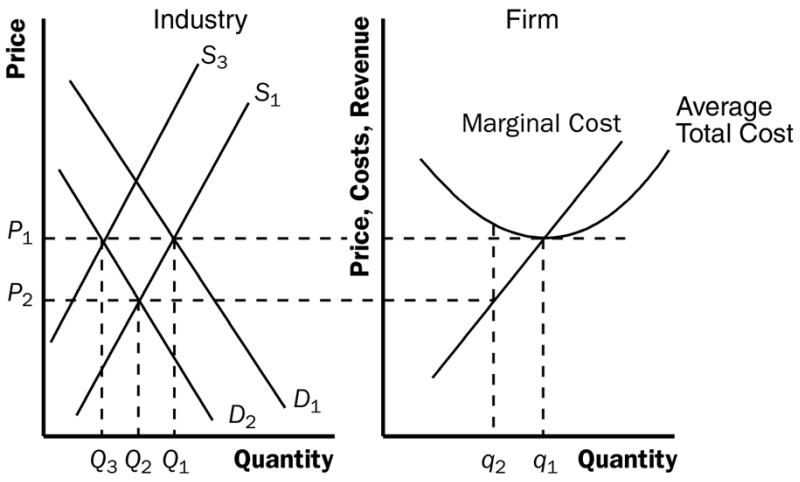

Figure 5

8. Figure 6 shows that although high prices cause an industry to expand, entry into the industry eventually returns prices to the point of minimum average total cost. In the figure, the industry is originally in long-run equilibrium. The industry produces output Q_1, where supply curve S_1 intersects demand curve D_1, and the price is P_1. At this point the typical firm produces output q_1. Since price equals average total cost at that point, the firm makes zero economic profit.

   Now suppose an increase in demand occurs, with the demand curve shifting to D_2. This causes "high prices" in the industry, as the price rises to P_2. It also causes the industry to increase output to Q_2. With the higher price, the typical firm increases its output from q_1 to q_2, and now makes positive profits, since price exceeds average total cost.

   However, the positive profits that firms earn encourage other firms to enter the industry. Their entry, "an expansion in an industry," leads the supply curve to shift to S_3. The new equilibrium reduces the price back to P_1, "bringing an end to high prices and manufacturers' prosperity," since now firms produce q_1 and earn zero profit again. The only long-lasting effect is that industry output is Q_3, a higher level than originally.

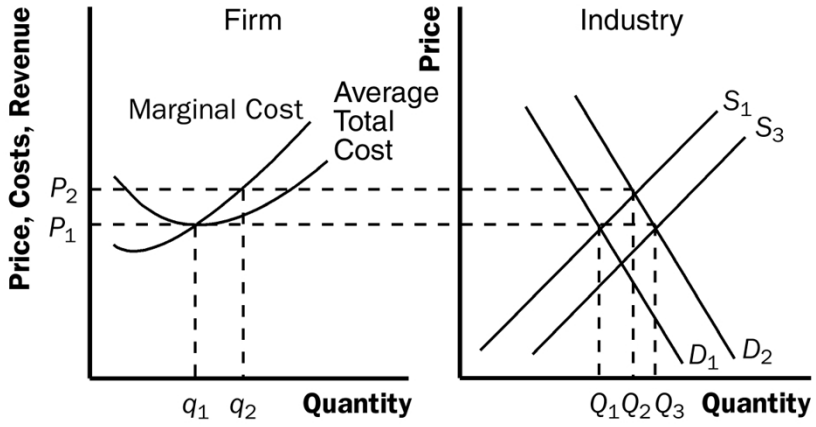

Figure 6

9. a. Figure 7 shows the typical firm in the industry, with average total cost ATC_1, marginal

cost MC_1, and price P_1.

b. The new process reduces Hi-Tech's marginal cost to MC_2 and its average total cost to ATC_2, but the price remains at P_1 since other firms cannot use the new process. Thus Hi-Tech earns positive profits.

c. When the patent expires and other firms are free to use the technology, all firms' average-total-cost curves decline to ATC_2, so the market price falls to P_3 and firms earn no profits.

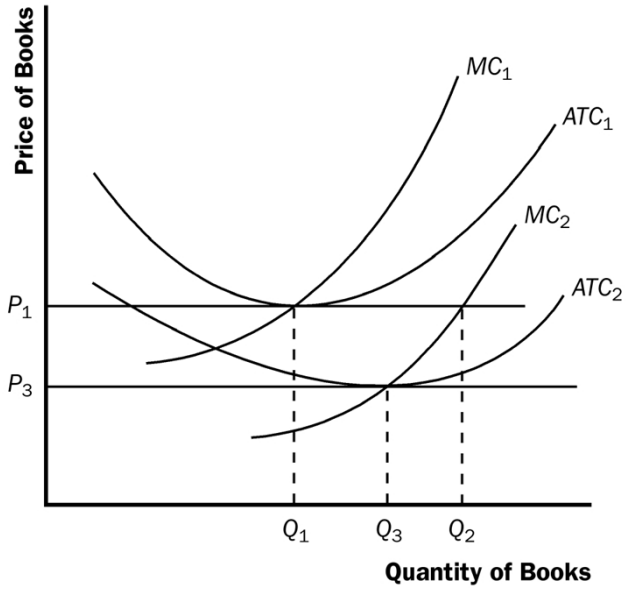

Figure 7

10. The rise in the price of petroleum increases production costs for individual firms and thus shifts the industry supply curve up, as shown in Figure 8. The typical firm's initial marginal-cost curve is MC_1 and its average-total-cost curve is ATC_1. In the initial equilibrium, the industry supply curve, S_1, intersects the demand curve at price P_1, which is equal to the minimum average total cost of the typical firm. Thus the typical firm earns no economic profit.

The increase in the price of oil shifts the typical firm's cost curves up to MC_2 and ATC_2, and shifts the industry supply curve up to S_2. The equilibrium price rises from P_1 to P_2, but the price does not increase by as much as the increase in marginal cost for the firm. As a result, price is less than average total cost for the firm, so profits are negative.

In the long run, the negative profits lead some firms to exit the industry. As they do so, the industry-supply curve shifts to the left. This continues until the price rises to equal the minimum point on the firm's average-total-cost curve. The long-run equilibrium occurs with supply curve S_3, equilibrium price P_3, industry output Q_3, and firm's output q_3. Thus, in the long run, profits are zero again and there are fewer firms in the industry.

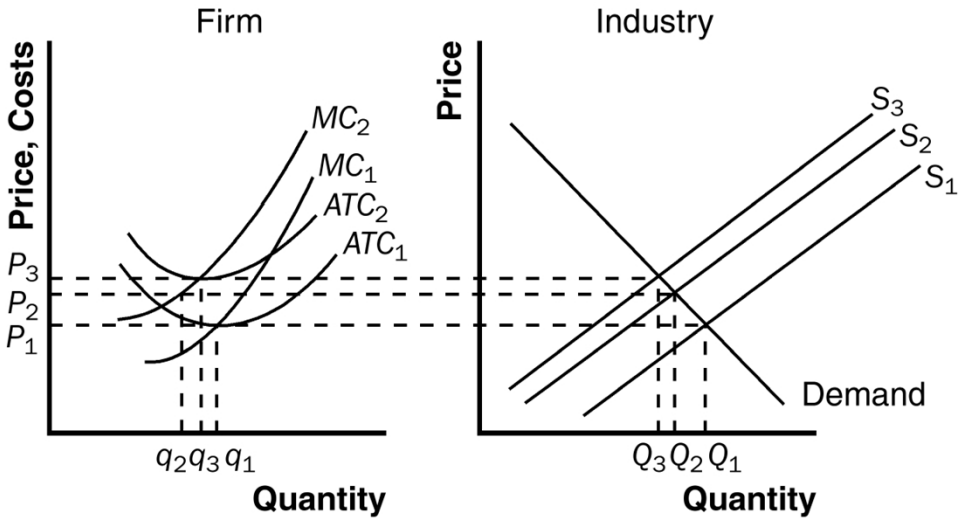

Figure 8

11. a. Figure 9 illustrates the situation in the U.S. textile industry. With no international trade, the market is in long-run equilibrium. Supply intersects demand at quantity Q_1 and price \$30, with a typical firm producing output q_1.

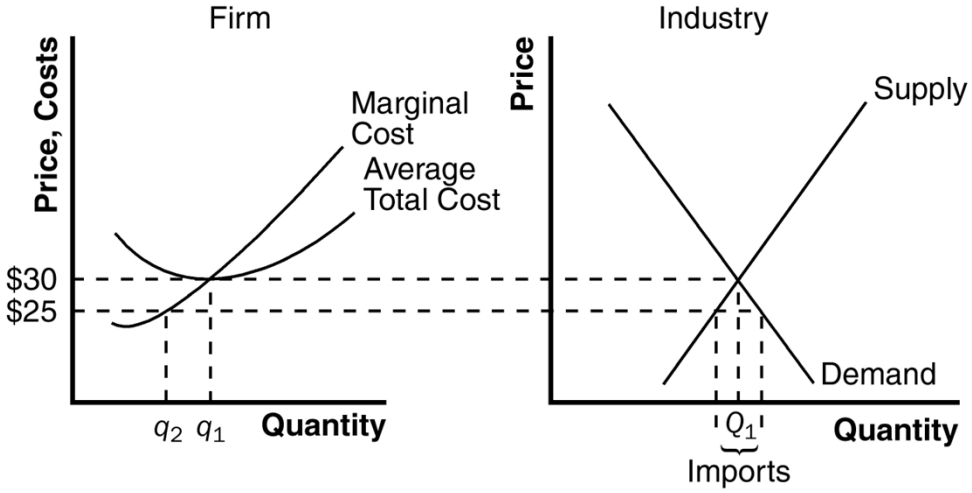

Figure 9

b. The effect of imports at \$25 is that the market supply curve follows the old supply curve up to a price of \$25, then becomes horizontal at that price. As a result, demand exceeds domestic supply, so the country imports textiles from other countries. The typical domestic firm now reduces its output from q_1 to q_2, incurring losses, since the large fixed costs imply that average total cost will be much higher than the price.

c. In the long run, domestic firms will be unable to compete with foreign firms because their costs are too high. All the domestic firms will exit the industry and other countries will supply enough to satisfy the entire domestic demand.

12. a. Figure 10 shows the current equilibrium in the market for pretzels. The supply curve,

S_1, intersects the demand curve at price P_1. Each stand produces quantity q_1 of pretzels, so the total number of pretzels produced is 1,000 x q_1. Stands earn zero profit, since price equals average total cost.

b. If the city government restricts the number of pretzel stands to 800, the industry-supply curve shifts to S_2. The market price rises to P_2, and individual firms produce output q_2. Industry output is now 800 x q_2. Now the price exceeds average total cost, so each firm is making a positive profit. Without restrictions on the market, this would induce other firms to enter the market, but they cannot, since the government has limited the number of licenses.

c. The city could charge a license fee for the licenses. Since it is a lump-sum fee for the license, not based on the quantity of sales, such a tax has no effect on marginal cost, so won't affect the firm's output. It will, however, reduce the firm's profits. As long as the firm is left with a zero or positive profit, it will continue to operate. So the license fee that brings the most money to the city is to charge each firm the amount (P_2 - ATC_2)q_2, the amount of the firm's profit.

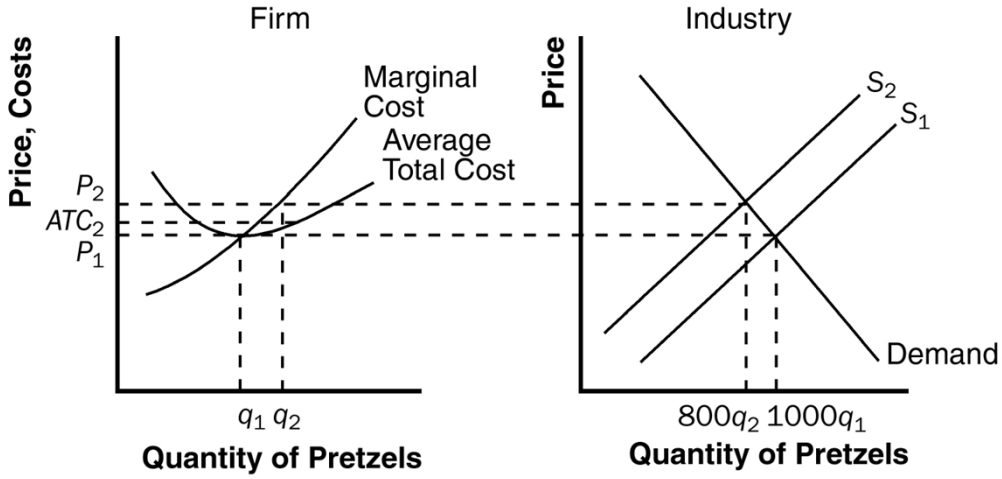

Figure 10

13. a. Figure 11 illustrates the gold market (industry) and a representative gold mine (firm). The demand curve, D_1, intersects the supply curve at industry quantity Q_1 and price P_1. Since the industry is in long-run equilibrium, the price equals the minimum point on the representative firm's average total cost curve, so the firm produces output q_1 and makes zero profit.

b. The increase in jewelry demand leads to an increase in the demand for gold, shifting the demand curve to D_2. In the short run, the price rises to P_2, industry output rises to Q_2, and the representative firm's output rises to q_2. Since price now exceeds average total cost, the representative firm now earns positive profits.

c. Since gold mines are earning positive economic profits, over time other firms will enter the industry. This will shift the supply curve to the right, reducing the price below P_2. But it's unlikely that the price will fall all the way back to P_1, since gold is in short supply. Costs for new firms are likely to be higher than for older firms, since they'll have to discover new gold sources. So it's likely that the long-run supply curve in the gold

industry is upward sloping. That means the long-run equilibrium price will be higher than it was initially.

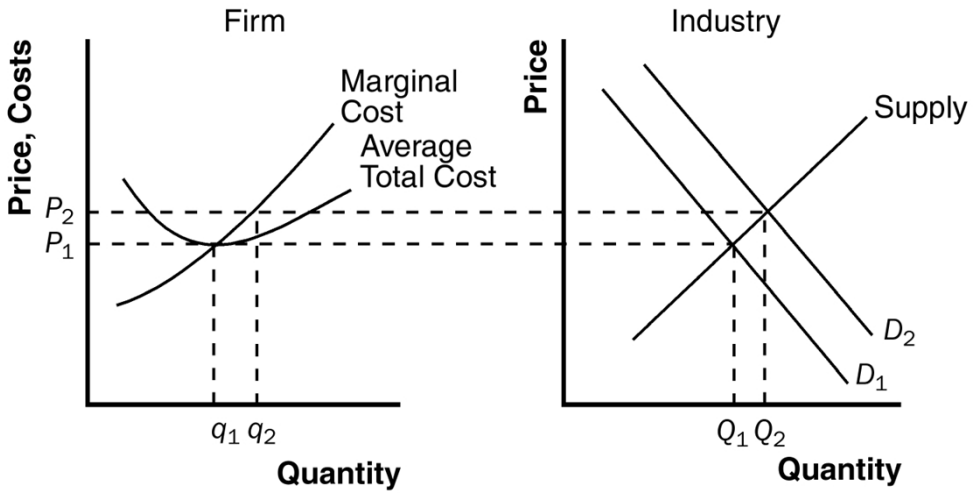

Figure 11

14. a. Figure 12 shows cost curves for a California refiner and a non-California refiner. Since the California refiner has access to lower-cost oil, its costs are lower.

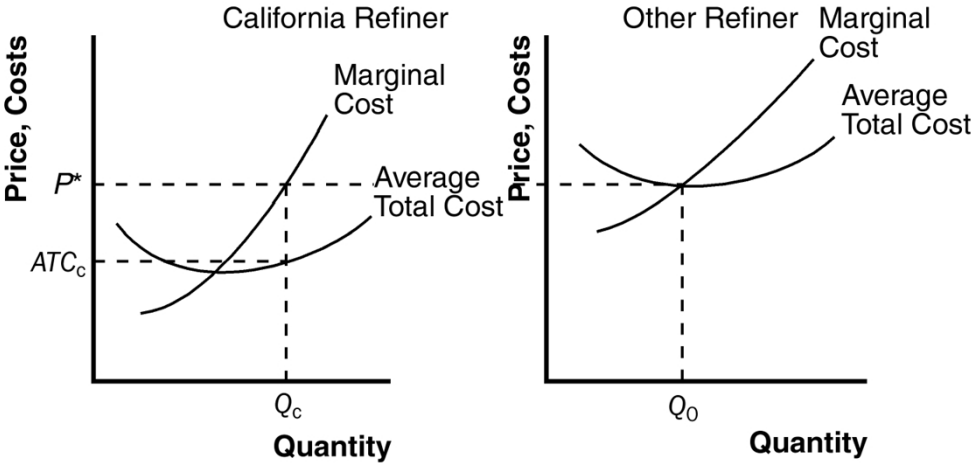

Figure 12

b. In long-run equilibrium, the price is determined by the costs of non-California refiners, since California refiners cannot supply the entire market. The market price will equal the minimum average total cost of the other refiners; they will thus earn zero profits. Since California refiners have lower costs, they will earn positive profits, equal to ($P^* - ATC_C$) x Q_C.

c. Yes, there is a subsidy to California refiners that is not passed on to consumers. The subsidy accounts for the long-run profits of the California refiners. It arises simply because the oil cannot be exported.