

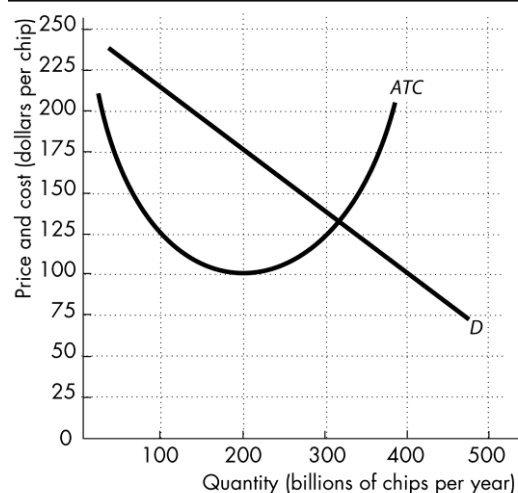
Chapter 15

- I. Intel and Advanced Micro Devices make most of the chips that power a PC. What makes the market for PC chips a duopoly? Sketch the market demand and cost curves that describe the situation in this market and that prevent other firms from entering.

The market for PC chips, in particular the processor, is a natural oligopoly, most likely a natural duopoly. There are only two firms in the market, Intel and AMD, and there are no legal barriers to entry which limit the number of firms to two. Because other firms *could* enter the market but do not do so supports the idea that this industry is a natural duopoly. The cost curves and demand curve for this market would be similar to those in Figure 15.1, which shows the situation for a market in which two firms can satisfy the market demand. In this situation if a new firm entered the market it would be at a significant cost disadvantage compared to Intel and AMD and would likely incur an economic loss. Such a prospect deters entry by new competitors.

FIGURE 15.1

Problem 1



4. Consider a game with two players who cannot communicate, and in which each player is asked a question. The players can answer the question honestly or lie. If both answer honestly, each receives \$100. If one player answers honestly and the other lies, the liar receives \$500 and the honest player gets nothing. If both lie, then each receives \$50.

- a. Describe the strategies and payoffs of this game.

The game has 2 players (A and B), and each player has 2 strategies: to answer honestly or to lie. There are 4 payoffs: Both answer honestly and both receive \$100; both lie and both receive \$50; A lies, and B answers honestly and A receives \$500 and B receives \$0; and B lies, and A answers honestly and A receives \$0 and B receives \$500.

- b. Construct the payoff matrix.

The payoff matrix has the following cells: Both answer honestly: A gets \$100, and B gets \$100; both lie: A gets \$50, and B gets \$50; A lies and B answers honestly: A gets \$500, and B gets \$0; B lies and A answers honestly: A gets \$0, and B gets \$500. The payoff matrix is to the right.

		A's strategies	
		Honest	Lie
B's strategies	Honest	\$100 \$100	\$500 \$0
	Lie	\$0 \$500	\$50 \$50

- c. What is the equilibrium of this game?

The equilibrium is that each player lies and gets \$50. If B answers

honestly, the best strategy for A is to lie because he would get \$500 rather than \$100. If B lies, the best strategy for A is to lie because he would get \$50 rather than \$0. So A's best strategy is to lie, no matter what B does. Repeat the exercise for B. B's best strategy is to lie, no matter what A does.

- d. Compare this game to the prisoners' dilemma. Are the two games similar or different? Explain.

The game is the same as a prisoners' dilemma. In this game, as in the prisoners' dilemma game, both players get the jointly worse equilibrium outcome because they cannot trust the other player to cooperate. If the players could cooperate, they would achieve a better result.

5. Soapy Inc. and Suddies Inc., the only soap-powder producers, collude and agree to share the market equally. If neither firm cheats, each makes \$1 million profit. If one firm cheats, it makes \$1.5 million, while the complier incurs a loss of \$0.5 million. If both cheat, they break even. Neither firm can monitor the other's actions.

- a. What are the strategies in this game? Construct the payoff matrix for this game.

Each firm has two strategies: to comply with the agreement or to cheat on the agreement.

The payoff matrix has the following cells: Both comply by the agreement: Soapy makes \$1 million profit, and Suddies makes \$1 million profit; both cheat: Soapy makes \$0 profit, and Suddies makes \$0 profit; Soapy cheats and Suddies complies with the agreement: Soapy makes \$1.5 million profit, and Suddies incurs a \$0.5 million loss; Suddies cheats and Soapy complies with the agreement: Suddies makes \$1.5 million profit, and Soapy incurs \$0.5 million loss. These payoffs are shown, in millions of dollars, in the matrix to the right.

- b. If the game is played only once what is the equilibrium? Is it a dominant-strategy equilibrium? Explain.

The equilibrium is that both firms cheat and each makes normal profit.

The equilibrium is a dominant strategy equilibrium because for each firm, regardless of the opponent's choice, the best strategy is to cheat. If Suddies complies with the agreement, the best strategy for Soapy is to cheat because it would make a profit of \$1.5 million rather than \$1 million. If Suddies cheats, the best strategy for Soapy is to cheat because it would make a profit of \$0 (the competitive outcome) rather than incur a loss of \$0.5 million. So Soapy's best strategy is to cheat, no matter what Suddies does. Repeating the exercise for Suddies shows that Suddies's best strategy also is to cheat, no matter what Soapy does.

		Soapy's strategies	
		Comply	Cheat
Suddie's strategies	Comply	\$1 M \$1 M	\$1.5 M -\$0.5 M
	Cheat	-\$0.5 M \$1.5 M	0 0

7. If Soapy Inc. and Suddies Inc. play the game in Problem 5 repeatedly, on each round of play:

- a. What strategies might each firm might adopt?

Each firm can adopt a tit-for-tat strategy or a trigger strategy, strategies that were not possible in a one-time game.

- b. Can the firms adopt a strategy that gives the game a cooperative equilibrium?

The game has a cooperative equilibrium. If the firms employ a trigger strategy or a tit-for-tat strategy, they can reach the cooperative comply/comply outcome. Take the case of the tit-for-tat strategy. If both firms comply for, say, three periods, both firms make \$3 million profit. If a firm cheats in the first period while its opponent complies, the cheater makes a \$1.5 million profit. In the second period, the

opponent cheats, so if the first firm complies, it loses \$0.5 million. In the third period the opponent will comply so the first firm can again cheat and make \$1.5 million. However, in these three periods the total profit is only \$2.5 million, so the cooperative equilibrium is possible.

- c. Would one firm still be tempted to cheat in a cooperative equilibrium? Explain your answer.

If the firms employ a trigger strategy or a tit-for-tat strategy, they can reach the cooperative comply/comply outcome. In these cases, the *long-run* profit from complying with the agreement exceeds that from cheating and so the cooperative equilibrium is likely. But a firm's *short-run* profit would be larger if the firm (and that firm alone) cheated. So each firm still has an incentive to cheat because each firm can temporarily increase its profit.

12. Asian Rice Exporters to Discuss Cartel

The Asian rice-exporting nations planned to discuss a proposal that they form a cartel. Ahead of the meeting, the countries said that the purpose of the rice cartel would be to contribute to ensuring food stability, not just in an individual country but also to address food shortages in the region and the world. The cartel will not hoard rice and raise prices when there are shortages. The Philippines says that it is a bad idea. It will create an oligopoly, and the cartel could price the grain out of reach for millions of people.

Source: CNN, May 6, 2008

- a. Assuming the rice-exporting nations become a profit-maximizing colluding oligopoly, explain how they would influence the global market for rice and the world price of rice.

To maximize their profit, the nations would decrease the quantity of rice they produce and raise its price. Similar to any monopoly, they would produce the quantity of rice so that the marginal cost equals the marginal revenue and then use the demand curve to determine the highest price that enables them to sell the profit-maximizing quantity.

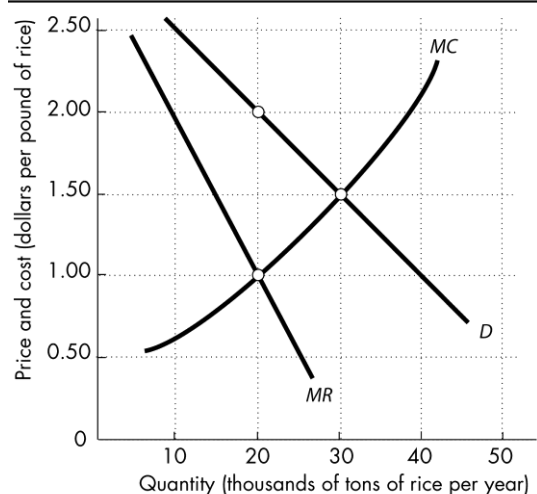
- b. Assuming the rice-exporting nations become a profit-maximizing colluding oligopoly, draw a graph to illustrate their influence on the global market for rice.

Figure 15.2 shows the outcome of this cartel in the market for rice. Before the oligopoly organized, the rice market was competitive. The equilibrium price and quantity were determined by the intersection of the market demand and market supply. In the figure the competitive market supply curve is MC , so before the oligopoly the equilibrium price was \$1.50 per pound and 30,000 tons of rice were produced. After the oligopoly organized, the equilibrium quantity decreases to 20,000 tons of rice and the price of a pound of rice rises to \$2.00 per pound.

- c. Even in the absence of international antitrust laws, why might it be difficult for this cartel to successfully collude? Use the ideas of game theory to explain.

The rice exporting countries will find it difficult to successfully collude for two reasons. First, as is the case in any successful cartel, the incentive is for each producer to cheat on the collusive agreement by producing more rice. This incentive lowers the likelihood that the cartel will succeed. In addition, the members of the cartel are not the only rice exporting countries. Other countries also export rice and, if the price of rice rises, still other countries could export rice. If the cartel is temporarily successful in raising the price, other nations will increase their production of rice, which will drive the price back down.

FIGURE 15.2
Problem 12b



18. Agile Airlines' profit on a route on which it has a monopoly is \$10 million a year. Wanabe Airlines is considering entering the market and operating on this route. Agile warns Wanabe to stay out and threatens to cut the price so that if Wanabe enters it will make no profit. Wanabe determines that the payoff matrix for the game in which it is engaged with Agile is shown in the table. Does Wanabe believe Agile's assertion? Does Wanabe enter or not? Explain.

Wanabe does not believe Agile's assertion. If Wanabe does not enter, Agile's best strategy is to set a high price. And, even if Wanabe enters the market, Agile's best strategy is to set a high price because Agile has a larger payoff from setting a high price, 7, than by setting a low price, 1. So Wanabe has no reason to believe Agile's assertion. Wanabe enters the market. If Wanabe does not enter, Wanabe receives a payoff of 0. If Wanabe enters, Agile sets a high price and so Wanabe receives a payoff of 5.

		Agile's strategies	
		High price	Low price
Wanabe's strategies	Enter	<div> <div>7</div> <div>5</div> </div>	<div> <div>1</div> <div>0</div> </div>
	Do not enter	<div> <div>10</div> <div>0</div> </div>	<div> <div>5</div> <div>0</div> </div>

Chapter 17

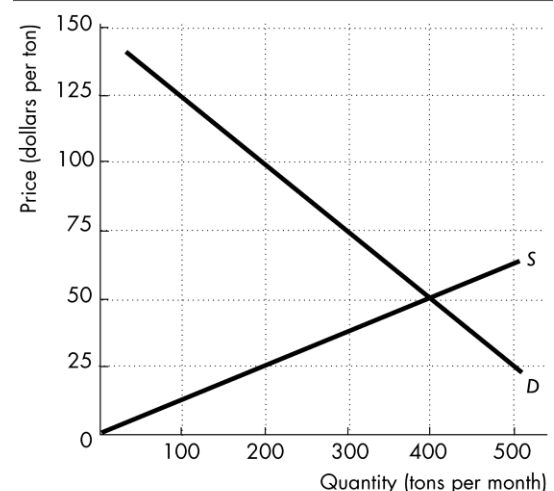
- Describe three consumption activities that create external costs.
Wearing heavy perfume creates an external cost; littering fast-food containers or soda cans creates an external cost; and, a drunk at a bar creates an external cost.
- Describe three production activities that create external benefits.
Presuming people like the smell of baking bread, a bakery creates an external benefit; basic research creates an external benefit; and recycling at a business has an external benefit because it decreases the harm created by waste disposal sites.

Use Figure 17.1, which illustrates the market for cotton, to work Problems 3 and 4. Suppose that the cotton growers use a chemical to control insects and waste flows into the town's river. The marginal social cost of producing the cotton is double the marginal private cost.

- If no one owns the river and the town takes no action to control the waste, what is the quantity of cotton and the deadweight loss created?
400 tons of cotton is produced. In Figure 17.2, the deadweight loss that is created is equal to the area of the grey triangle. So the deadweight loss is equal to $\frac{1}{2} \times (\$75 \text{ per ton} - \$37.50 \text{ per ton}) \times 100 \text{ tons}$, which is \$1,875.
- If the town owns the river and taxes cotton growers so that the efficient quantity is grown. How much tax revenue does the town receive? Is the quantity of waste zero? Explain your answer.

The tax is equal to the marginal external cost at the

FIGURE 17.1
Problems 3 and 4



efficient quantity, \$37.50 per ton of cotton. The efficient quantity of cotton is produced, 300 tons. Therefore the town receives $\$37.50 \text{ per ton} \times 300 \text{ tons}$, which is \$11,250. The quantity of waste is not zero because 300 tons of cotton are produced. But the quantity produced is the efficient amount, so the marginal social benefit from the last ton of cotton produced equals the marginal social cost, which includes the external cost.

Use Figure 17.3 to work Problems 5 and 6.

The figure illustrates the market for North Atlantic tuna.

5. a. What is the quantity of tuna that fishers catch and the price of tuna? Is the tuna stock being used efficiently? Explain why or why not.
When the market is unregulated, the quantity of fish caught and their price is determined by the equilibrium between supply and demand. The demand curve is the same as the *MSB* curve so Figure 17.3 shows that the equilibrium quantity of tuna is 80 tons and the equilibrium price is \$100 per ton. The tuna stock is not being used efficiently. The efficient quantity of tuna is determined by the intersection of the *MSC* curve and the *MSB* curve. Figure 17.3 shows that the efficient quantity of tuna is 40 tons. Tuna, a common resource, is overfished.
- b. What would be the price of tuna, if the stock of tuna were used efficiently?
If tuna were used efficiently, 40 tons per month would be caught and the price would be \$150 per ton.
6. With a quota of 40 tons a month for the tuna fishing industry, what is the price of tuna and the quantity caught? Does overfishing occur?
With a quota of 40 tons per month, the quantity of tuna caught will be 40 tons and the price will be \$150 per ton. As long as the quota is enforced so that fishers cannot cheat on their allocation, the equilibrium with the 40-ton quota is efficient. Tuna is not overfished.

Use Figure 17.4, which shows the demand for college education, to work Problems 7 to 9.

The marginal cost is a constant \$6,000 per student per year. The marginal external benefit from a college education is a constant \$4,000 per student per year.

7. What is the efficient number of students? If all

FIGURE 17.2
Problem 3

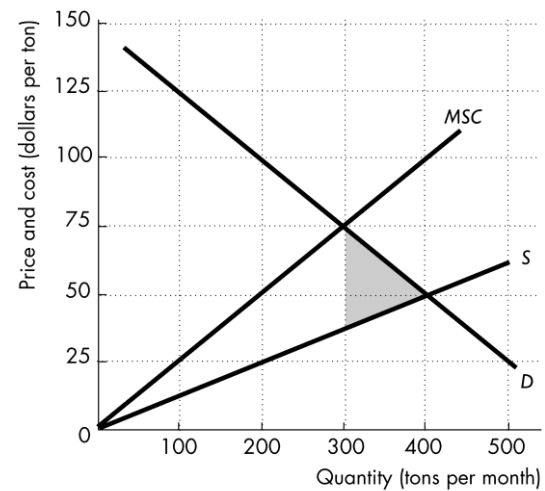


FIGURE 17.3
Problems 5 and 6

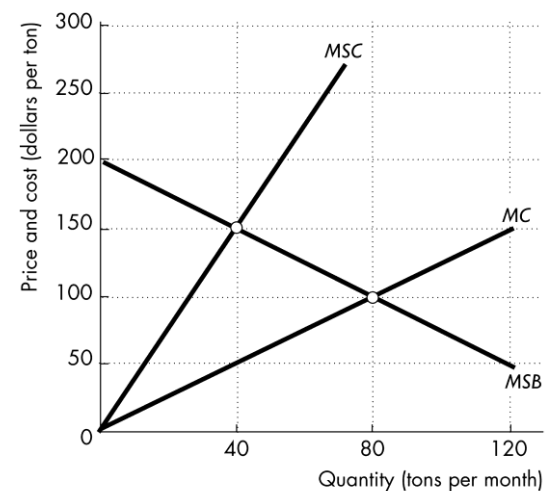
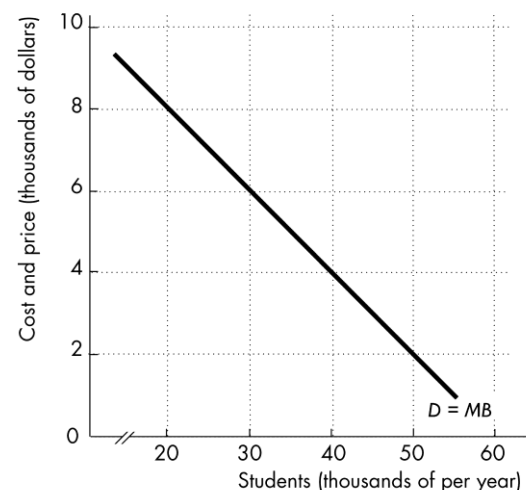


FIGURE 17.4
Problems 7 to 9



colleges are private, how many people enroll in college and what is the tuition?

The efficient number of students is 50,000 because this quantity is the number of students that sets the marginal *social* benefit equal to the marginal cost. If all colleges are private, then 30,000 students enroll in college because this quantity is the number that sets the marginal benefit equal to the marginal cost.

8. If the government provides public colleges, what tuition will achieve the efficient number of students? How much will taxpayers have to pay?

The tuition will be \$2,000 because this tuition will lead 50,000 students to enroll. The taxpayers must pay \$4,000 per student (the \$6,000 marginal cost minus the \$2,000 tuition) for 50,000 students, so the taxpayers will pay \$200,000,000 in total.

9. If the government offers students vouchers, what is the value of the voucher that will achieve the efficient number of students?

The efficient number of students is 50,000. The value of the voucher must be \$4,000 a student. The private colleges charge tuition of \$6,000 per student and, of this tuition, students pay \$2,000 so 50,000 students enroll.
