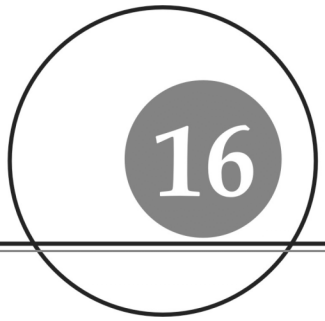


16 Government Regulation of Business

Learning Objectives

After reading Chapter 16 and working the problems for Chapter 16 in the textbook and in this Workbook, you should be able to:

- Define the concept of social economic efficiency and relate it to productive efficiency, allocative efficiency, and maximization of social surplus.
- Explain why well-functioning competitive markets achieve social economic efficiency without the need for government regulation.
- List six types of market failure that can cause competitive markets to fail to achieve social economic efficiency, thereby creating an opportunity for government regulation of business to increase social surplus.

Essential Concepts

This chapter is divided into six sections and the *Essential Concepts* for this chapter are organized accordingly.

16.1 MARKET COMPETITION AND SOCIAL ECONOMIC EFFICIENCY

1. *Social economic efficiency* exists when the goods and services that society desires are produced and consumed with no waste from inefficiency in either production or consumption. To reach this goal, two efficiency conditions must be fulfilled: *productive efficiency* and *allocative efficiency*.
2. *Productive efficiency* exists when suppliers produce goods and services at the lowest possible total cost to society. Productive efficiency happens when firms operate along their expansion paths in both the short-run and long-run periods.
3. *Allocative efficiency* requires businesses to supply the optimal amounts of all goods and services demanded by society, *and* these units must be rationed to individuals who place the highest value on consuming them. The optimal level of output is reached when the marginal benefit of another unit to consumers just equals the marginal cost to society of producing another unit, which is the point on demand where $P = MC$ (i.e., *marginal-cost-pricing* is required).
4. Markets in perfectly competitive equilibrium achieve social economic efficiency because, at the intersection of demand and supply curves, conditions for both productive efficiency and allocative efficiency are met. At the competitive market-

clearing price, buyers and sellers engage in voluntarily exchange that maximizes social surplus.

16.2 MARKET FAILURE AND THE CASE FOR GOVERNMENT INTERVENTION

1. Competitive markets can accomplish maximization of social surplus (i.e., achieve social economic efficiency) without government regulation.

2. Unfortunately, not all markets are competitive, and even competitive markets can sometimes fail to achieve maximum social surplus. *Market failure* occurs when a market fails to achieve social economic efficiency, and, consequently, fails to maximize social surplus.

3. Six forms of market failure can undermine economic efficiency: Monopoly power, natural monopoly, negative (and positive) externalities, common property resources, public goods, and information problems.

4. Absent market failure, no efficiency argument can be made for government intervention in competitive markets. As long as competitive equilibrium works to maximize social surplus, any government intervention that moves the market away from competitive equilibrium will reduce social surplus.

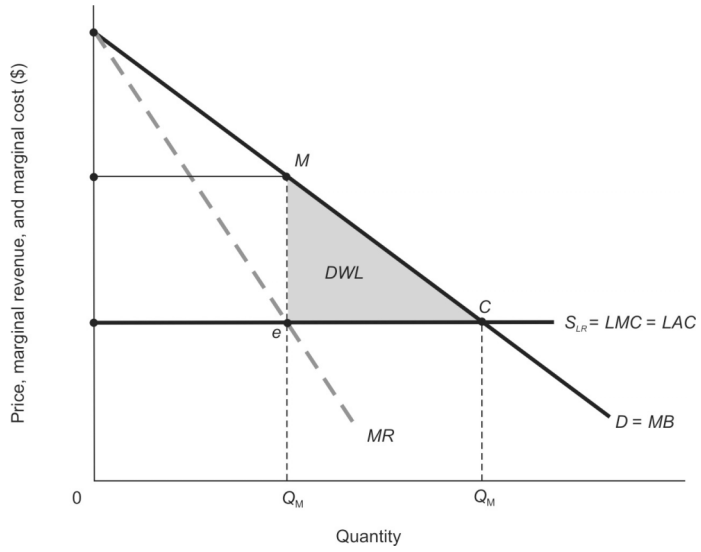
16.3 MARKET POWER AND PUBLIC POLICY

1. Only perfectly competitive markets meet the necessary condition for allocative efficiency: marginal-cost pricing. Price always exceeds marginal cost under monopoly, monopolistic competition, and oligopoly because of the *market power* that all imperfectly competitive firms possess.

2. For all firms with market power, marginal revenue lies below the firm's demand curve. For this reason, prices charged by firms with market power always exceed marginal revenue: $P > MR$. Since profit-maximization requires producing at the output level for which $MR = MC$, it follows directly that firms with market power must price above marginal cost ($P > MC$) to maximize profit. Consequently, firms possessing market power fail to achieve allocative efficiency, which reduces social surplus.

3. While any degree of market power reduces social surplus, a "high" degree of market power may do so much damage to social surplus that a government remedy may be warranted. When the degree of market power grows high enough, antitrust officials refer to it legally as "*monopoly power*." No clear legal threshold has been established by antitrust authorities to determine when "market power" constitutes "monopoly power."

4. Allocative efficiency is lost when firms possess market power because their profit-maximizing price does not result in marginal-cost-pricing. Consequently, for the last unit of output produced and sold at the profit-maximizing point, the marginal benefit exceeds the marginal cost of production, and resources are underallocated to the industry. As a result of this allocative inefficiency, social surplus falls by the amount of the gray-shaded triangle *eCM* in the figure below:



This lost surplus is called "*deadweight loss*" because the surplus lost on units not produced represents a complete loss of surplus to society.

Promoting Competition Through Antitrust Policy

5. Monopoly power, or a high degree of market power, can arise primarily in three ways: (1) actual or attempted monopolization, (2) price-fixing cartels, and (3) mergers among horizontal competitors.

6. Firms may be found guilty of *actual* monopolization only if *both* of the following conditions are met: (1) the behavior is judged to be undertaken solely for the purpose of creating monopoly power, and (2) the firm successfully achieves a high degree of market power. Businesses can also be guilty of *attempted* monopolization if they engage in conduct intended to create a monopoly and there is a "dangerous probability of success."

Natural Monopoly and Market Failure

7. Natural monopoly arises when a single firm can produce the total consumer demand for a product or service at a lower long-run total cost than if two or more firms produce the total industry output.

8. Natural monopoly is another way of saying that long-run costs are *subadditive* at the level of output demanded by consumers. Long-run costs are **subadditive** at a particular output level $\overline{Q}$ if any division of $\overline{Q}$ among two or more firms is more costly than letting a monopoly produce all $\overline{Q}$ units. Thus the terms "natural monopoly" and "subadditive costs" mean exactly the same thing.

9. Breaking up a natural monopoly is undesirable because increasing the number of firms in the industry drives up total cost and undermines productive efficiency. State regulators of public utilities –known as "public utility commissions" (*PUC*s) or "public service commissions" (*PSC*s)– face a challenging task in regulating the price that natural monopolies can charge. Regulators would like to force a pricing structure on natural monopolies that creates the social economic efficiency

outcome under perfect competition. Under natural monopoly, no single price can establish social economic efficiency.

10. When *LAC* is declining due to economies of scale, marginal-cost-pricing creates a situation in which the regulated natural monopoly earns negative economic profit. Although average-cost-pricing supports financial viability of the natural monopoly, it still fails to achieve a socially efficient outcome because too little output is produced (i.e., allocative inefficiency exists).

11. *Two-part pricing* is a pricing solution that can meet both efficiency conditions and maximize social surplus. A two-part pricing plan charges customers a fixed access charge (A) plus an additional usage fee (f) based on the number of units purchased. By wisely setting the access charge and usage fee, regulatory authorities can solve the natural monopoly pricing dilemma: set the usage fee equal to marginal cost and set the fixed access charge to spread the loss caused by marginal-cost-pricing across all customers.

16.4 THE PROBLEM OF NEGATIVE EXTERNALITY

1. Another important cause of market failure in competitive markets arises when the actions taken by market participants create either benefits or costs that spillover to other members of society. When these spillover effects are beneficial to society, economists call them *positive externalities*. Alternatively, when spillover effects are costly to society, economists call them *negative externalities*.

2. External or spillover benefits and costs undermine allocative efficiency, because market participants, when making consumption and production decisions, rationally choose to ignore the benefits and costs of their actions that spillover to external members of society. Consequently, competitive market prices do not capture the social benefits or costs that spillover to other members of society.

3. Managers rationally ignore external costs when making profit-maximizing production decisions. The social cost of production is the sum of private cost incurred by producers plus any external or spillover cost imposed on other members of society:

$$\text{Social cost} = \text{Private cost} + \text{External cost}$$

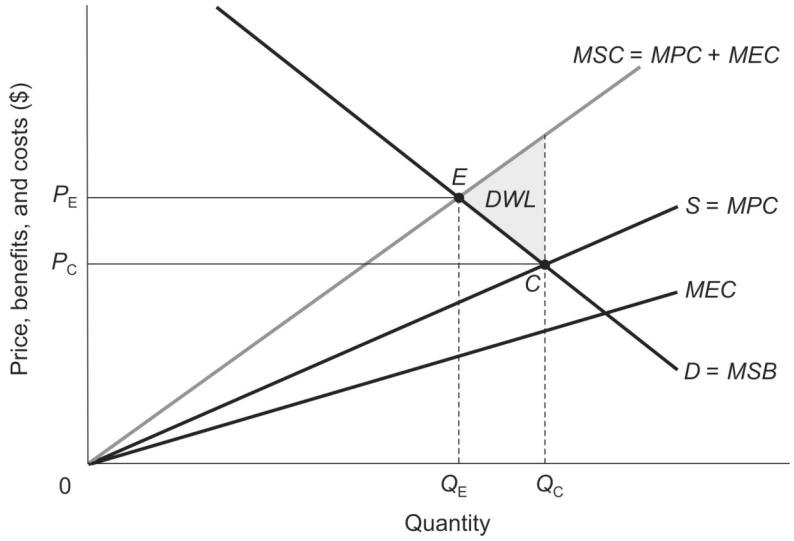
Economists sometimes say that a negative externality drives a "wedge" between social and private costs of production:

$$\text{Social cost} - \text{Private cost} = \text{External cost}$$

The larger the external costs of a negative externality, the greater the difference between social and private costs of production, and the greater the resulting deadweight loss.

4. Figure 16.5 in the text (reproduced below) shows why the "wedge" of negative externality makes allocative efficiency impossible to achieve in competitive markets. Competitive market equilibrium is established at the intersection of demand and supply (point C), where Q_C units are produced and consumed at price P_C. Production of this good by competitive suppliers creates an external cost that spills over to society. The marginal external cost, shown as *MEC* in Figure 16.5, increases with the level of output. At every output level, the marginal social cost

curve is the vertical sum of the marginal private cost and marginal external cost: $MSC = MPC + MEC$.



In competitive equilibrium, too much output is produced because *MSC* exceeds *MSB* at point *C*. Allocative efficiency occurs at Q_E (point *E*), where *MSC* equals *MSB*. By producing the units from Q_E to Q_C, the competitive industry creates a deadweight loss on each unit that costs more to produce than its worth to society. The area of the shaded triangle *DWL* is the amount by which social surplus is reduced by overproducing and overconsuming the good.

16.5 NONEXCLUDABILITY

1. When access to a good or a scarce resource cannot be excluded, market failure may result. Two kinds of market failure caused by lack of excludability: *common property resources* and *public goods*.

2. *Common property resources* are resources for which property rights are completely absent or so poorly defined that no one can effectively be excluded from accessing these resources. In the absence of any government intervention, common property resources are generally over exploited and undersupplied.

3. *Public goods* are characterized by two properties: they are *nonexcludable*, and they are *nondepletable*. In the case of public goods, the problem of nonexcludabiltiy is called the *free-rider problem*: suppliers of a good cannot prevent nonpayers from consuming the good or service. If the free-rider problem is severe, firms cannot collect sufficient revenue to cover costs, and no firm will produce any of the afflicted good. A good is *nondepletable* (or nonrivalrous) in consumption if one person's consumption of the good causes no reduction in the amount or quality of the good available for consumption to other members of society.

4. A pure public good is nonexcludable and nondepletable. The inability to exclude nonpayers creates a free-rider problem for the private provision of public goods. Even when private firms do supply public goods, a deadweight loss can be avoided only if the price of the public good is zero.

16.6 INFORMATION AND MARKET FAILURE

1. Market failure may also occur because consumers do not possess perfect knowledge. Perfect knowledge includes knowledge by consumers about product *prices* and *qualities*, including the hazards associated with a product.

2. Market power emerges in competitive markets because imperfectly informed consumers do not possess complete knowledge of all producers and prices. Their incomplete knowledge about substitutes creates market power for sellers, something that did not happen in the model of perfect competition. Thus, imperfect information about sellers and prices can cause market failure in competitive markets.

3. Consumers may over- or under-estimate the quality of the goods and services they buy. If they over- (under-) value quality, they will demand too much (little) product relative to the allocatively efficient amount

Matching Definitions

abatement
allocative efficiency
common property resources
deadweight loss
emission taxes
free-rider problem
government failure
market failure
market power
marginal-cost-pricing
marginal damage
monopoly power
natural monopoly
negative externalities
nondepletable
positive externalities
productive efficiency
public goods
rationing function of prices
second-best pricing
social economic efficiency
subadditive
total abatement cost
total damage
two-part pricing
unitization

1. _____ Government intervention that reduces social surplus.
2. _____ Setting price as close as possible to marginal cost, but just high enough to insure zero economic profit.
3. _____ Inability of suppliers to prevent nonpayers from consuming their output.
4. _____ A process by which prices serve to ration goods to their highest-valued users through voluntary exchange.
5. _____ Costly efforts undertaken by firms to reduce or prevent emission of pollution from their production facilities.
6. _____ One person's consumption of a good causes no reduction in the quantity or quality available to other members of society.
7. _____ Costs that any division of $\overline{Q}$ among two or more firms is more costly than letting one firm produce it all.
8. _____ Assigning equal property rights to a resource, regardless of which owner produces and sells the resource.
9. _____ Occur when the actions of buyers or sellers create spillover or external benefits to the other members of society.
10. _____ Optimal levels of all goods are produced and sold to consumers who value them most.
11. _____ Total cost of abating pollution; measured by the area under *MAC*.
12. _____ Goods that are both nonexcludable and nondepletable.
13. _____ Industry output is produced at lowest possible total cost to society.

14. _____ Taxes levied on each ton of pollution discharged into the environment.

15. _____ Social surplus lost on units not produced when price diverges from marginal cost.

16. _____ Additional damage incurred by society by discharging one more unit of pollution into the environment.

17. _____ Condition for allocative efficiency that price equals marginal cost.

18. _____ Occur when the actions of buyers or sellers create spillover or external costs to the other members of society.

19. _____ When production and consumption are organized in a way that fulfills two efficiency conditions: productive efficiency and allocative efficiency.

20. _____ Resources for which property rights are absent or poorly defined, which leads to overuse and underproduction.

21. _____ An ability to raise price without losing all sales.

22. _____ Dollar measure of all damages to society caused by pollution emissions.

23. _____ One firm can produce the entire industry output at lower total cost than two or more firms.

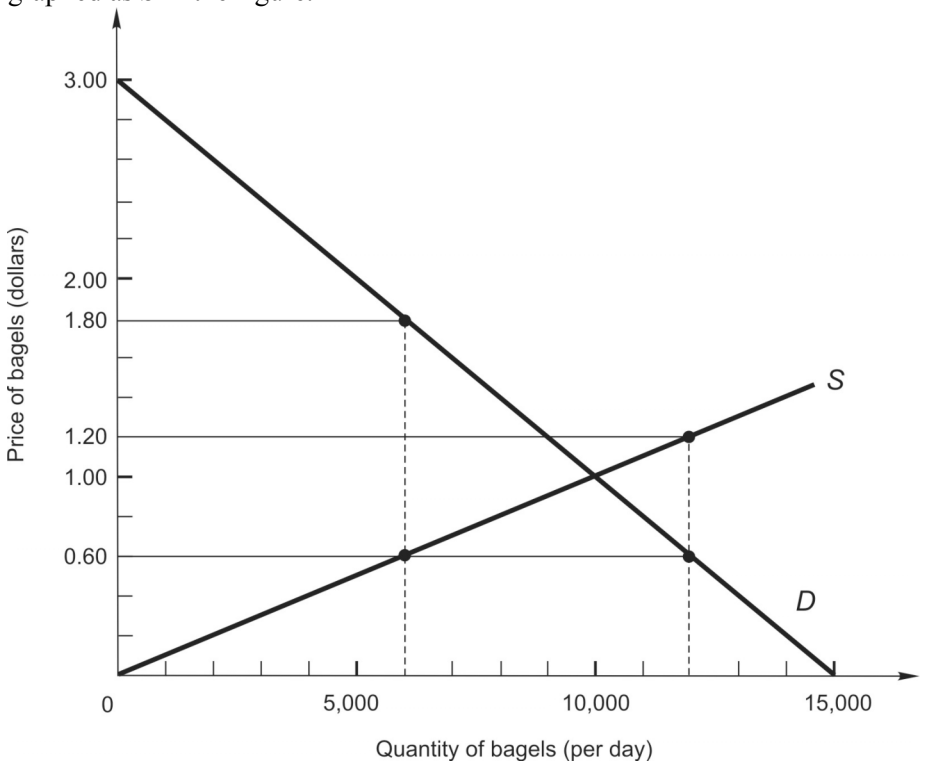
24. _____ When a market fails to reach an equilibrium that achieves social economic efficiency and thus fails to maximize social surplus.

25. _____ Utility customers pay a usage fee for each unit purchased plus a fixed access charge.

26. _____ A poorly defined legal term used in antitrust law to refer to a high degree of market power.

Study Problems

1. The market for bagels in Boston City is perfectly competitive. In Boston City, the daily demand for bagels is $Q_d = 15{,}000 - 5{,}000P$, which is graphed as D in the figure below. The industry supply of bagels in Boston is $Q_s = 10{,}000P$, which is graphed as S in the figure.



   a. What is the market-clearing price of bagels in competitive equilibrium? How many bagels are bought and sold daily in Boston? (You can solve mathematically using the equations for demand and supply, or you can use the demand and supply lines in the figure, which are drawn precisely to scale.)

   b. Explain why the Boston bagel market is expected to achieve productive efficiency in competitive equilibrium.

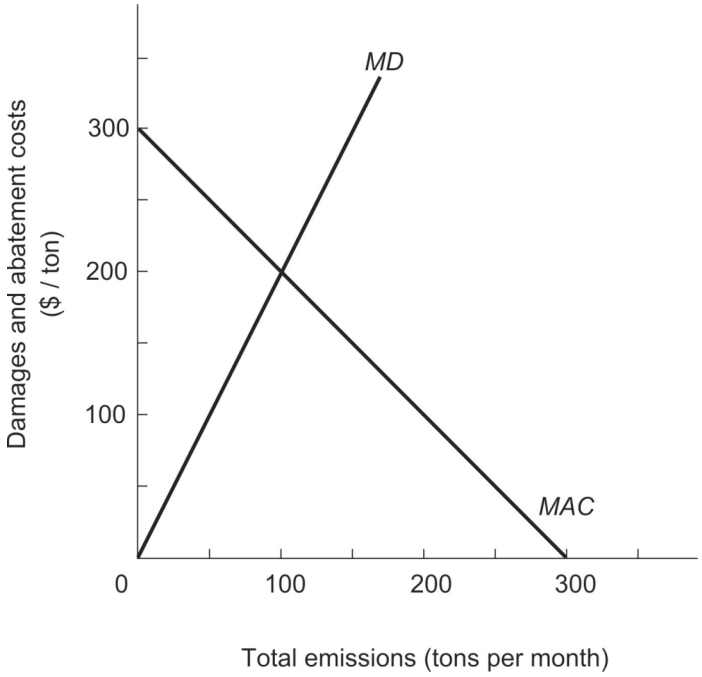
   c. Suppose that Boston bagel businesses charged a price of $1.80 and sold 6,000 bagels per day. Explain carefully why society would benefit from an increase in bagel production.

   d. Suppose that Boston bagel businesses produced 12,000 bagels per day and charged a price of $0.60. Explain carefully why society would benefit from a decrease in bagel production.

   e. How does the market-clearing price found in part *a* serve to ration bagels to the consumers who place the highest value on them?

   f. Does the Boston bagel market achieve social economic efficiency? Why?

2. Using the demand and supply conditions given in Study Problem 1, answer the following questions concerning consumer, producer, and social surplus in the Boston City bagel market.
   a. For the 6,000th bagel sold each day in Boston, compute the consumer surplus, producer surplus, and social surplus when the price of a bagel is $1.00.
   b. Compute total consumer, producer, and social surplus when 6,000 bagels per day are produced and consumed at a market price of $1.00.
   c. At the equilibrium price and quantity, compute social surplus. Is your computed value for social surplus in competitive equilibrium higher or lower than your computed value for social surplus at 6,000 bagels per day in part *c*? Is this what you expected? Explain.
3. Under the demand and supply conditions given in Study Problem 1, suppose that the mayor of Boston asks city council to impose a price ceiling on bagels sold in Boston. If the ceiling price is set at $0.60 per bagel, answer the following questions (and assume that bagels are somehow rationed to the highest-valued consumers):
   a. Does the ceiling price cause a surplus or shortage of bagels in Boston? What is the amount of the surplus or shortage?
   b. Calculate consumer surplus under the price ceiling. Are bagel consumers in Boston better off with the mayor's price ceiling on bagels? Explain carefully.
   c. Calculate producer surplus under the price ceiling. Are Boston bagel producers better off with the mayor's price ceiling on bagels? Explain carefully.
4. The figure on the next page shows the marginal damage (*MD*) curve and the marginal abatement cost (*MAC*) curve facing an industry that discharges a pollutant into the environment.
   a. If environment regulations do not restrict pollution by this industry, the industry would discharge _____ tons per month. At this level of emissions, total damage caused by pollution would be $_____ per month, and total abatement cost would be $_____ per month. Total social cost of pollution in this industry would be $_____ per month in the absence of any government restrictions on pollution.
   b. If environmental officials banned all pollution, forcing the industry to eliminate all pollution discharges, then total abatement cost for the industry would be $_____ per month, and total social cost of zero pollution in this industry would be $_____ per month.



c. If environment regulations do not restrict pollution by this industry, the industry would discharge _____ tons per month. At this level of emissions, total damage caused by pollution would be $_____ per month, and total abatement cost would be $_____ per month. Total social cost of pollution in this industry would be $_____ per month in the absence of any government restrictions on pollution.

d. If environmental officials banned all pollution, forcing the industry to eliminate all pollution discharges, then total abatement cost for the industry would be $_____ per month, and total social cost of zero pollution in this industry would be $_____ per month.

e. Why is zero pollution in this industry not optimal from society's point of view? Explain carefully using the figure above.

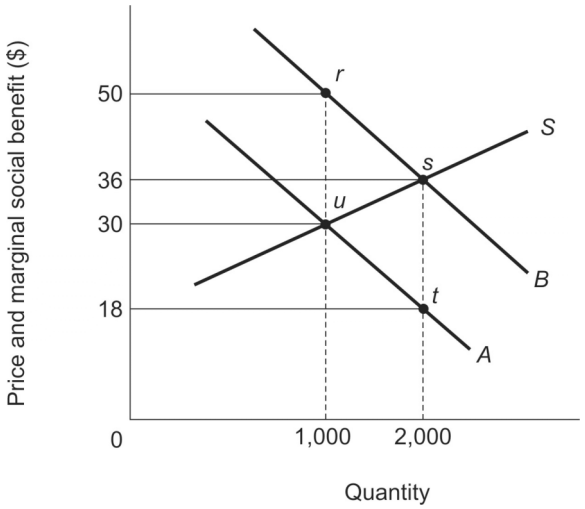
f. The socially optimal level of emissions for this industry is _____ tons per month, which results in total abatement cost of $_____ per month, and total damage from pollution of $_____ per month. Total social cost is $_____ per month.

g. At the optimal level of pollution in part *d*, exactly what is maximized or minimized?

h. What is the optimal level of abatement from society's point of view?

i. If environmental authorities wished to control pollution in this industry by imposing an emission tax on pollution, the tax per ton of discharge should be set at $_____ per ton. At this tax rate, the industry discharges _____ tons per month and pays a total tax bill of $_____ per month. The industry abates _____ tons per month and incurs total abatement cost of $_____ per month.

5. In the figure below, consumers buy a good that is competitively supplied. Consumers are poorly informed about the quality of the good, and they believe the quality of the good is higher than the true quality of the good.



a. Curve *A* in the figure represents _____ (demand, marginal social benefit) for the good in this market, and curve *B* represents _____ (demand, marginal social benefit) for the good**.**

b. In competitive equilibrium, the price is $_____ and _____ units are produced and consumed.

c. Allocative inefficiency arises because, at the competitive output level, the marginal social benefit is $_____, which is _____(smaller, larger) than $_____, which is the marginal social cost in competitive equilibrium.

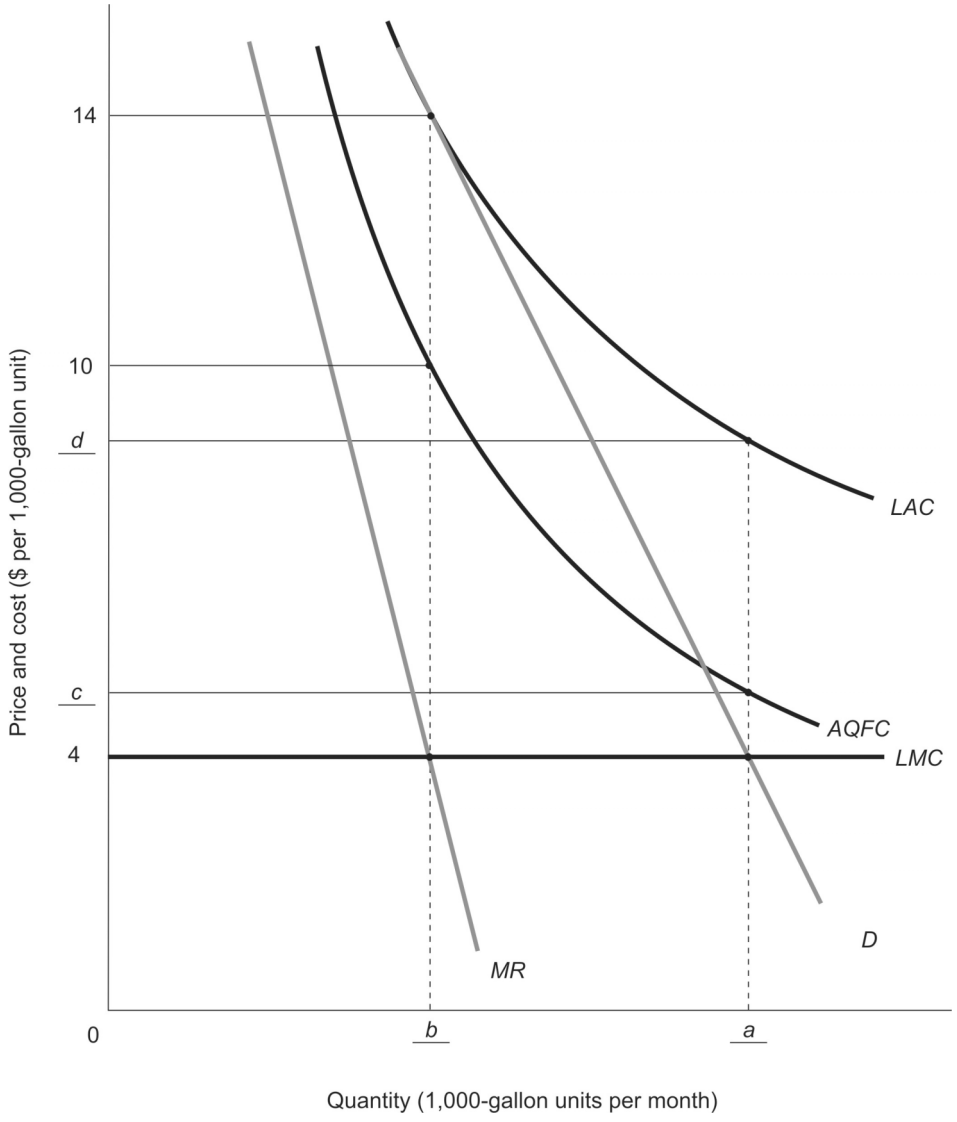
d. The deadweight loss caused by imperfect information about product quality is $_____.

Multiple Choice / True-False

1. Social economic efficiency means that the market is achieving
   a. productive efficiency.
   b. allocative efficiency.
   c. maximum possible consumer surplus.
   d. both *a* or *b*
   e. all of the above

2. _____ is/are example(s) of market failure that could justify government intervention in the market.
   a. Imperfect information
   b. Public goods
   c. A perfectly competitive bagel market
   d. A dominant firm that undertakes pricing strategies aimed at maintaining high entry barriers
   e. only *a*, *b*, and *d*

For questions 3-12 refer to the following information:
A municipal water utility employs quasi-fixed capital inputs—are the water treatment plant and distribution lines to homes—to supply water to 20,000 households in the community it serves. The figure below shows the cost structure of this utility for various levels of water service. Quantity of water consumption is measured in 1,000-gallon units per month. *AQFC* is the average quasi-fixed cost curve, and *LAC* is long-run average cost. Long-run marginal cost, *LMC*, is constant and equal to \$4 per 1,000-gallon unit. The inverse demand equation is $P = 24 - 0.0004Q_d$.



3. The value in blank *a* in the figure is ____.
   a. 40,000
   b. 45,000
   c. 50,000
   d. 55,000
   e. none of the above

4. The value in blank *b* in the figure is ____.
   a. 22,500
   b. 25,000
   c. 27,500
   d. 30,000
   e. none of the above

5. The value in blank *c* in the figure is ____.
   a. $4.65
   b. $4.75
   c. $4.80
   d. $5.50
   e. none of the above

6. The value in blank *d* in the figure is ____.
   a. 6.50
   b. 7.50
   c. 8.00
   d. 9.50
   e. none of the above

7. Quasi-fixed capital inputs cost per month is $____.
   a. 150,000
   b. 200,000
   c. 250,000
   d. 300,000
   e. 350,000

8. The price and output of water that maximize social surplus are _____ and _____, respectively.
   a. $9.00; 50,000
   b. $4.00; 25,000
   c. $4.00; 50,000
   d. none of the above

9. Regulators at the Public Service Commission are unlikely to choose the price in question 8 because
   a. the water utility company will lose money at that price.
   b. the utility company will require a subsidy to continue operation in the long run.
   c. government failure is a common problem at Public Service Commissions.
   d. both *a* and *b*
   e. all of the above

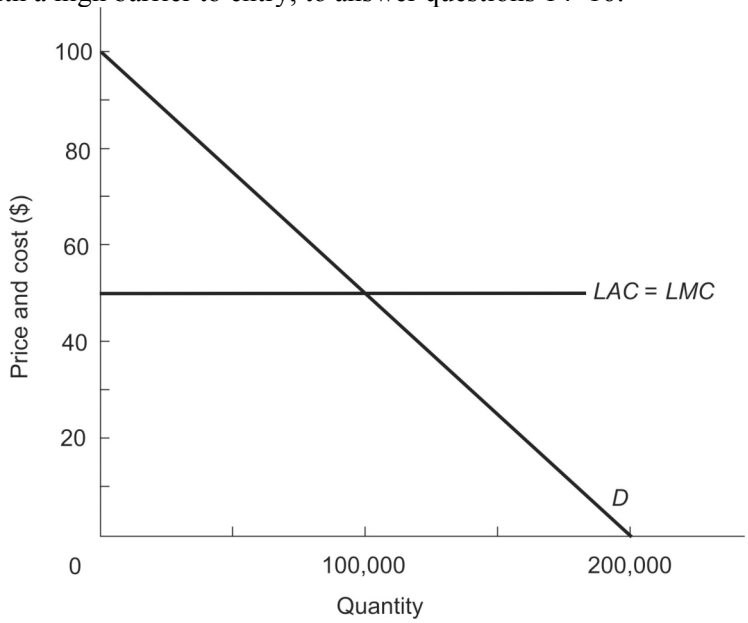
10. If the Public Service Commission undertakes second-best pricing, the price and output of water are _____ and _____, respectively.
    a. $2.00; 55,000
    b. $9.00; 50,000
    c. $2.50; 27,500
    d. $9.50; 55,000
    e. none of the above

11. Second-best pricing does not achieve social economic efficiency because there is a dead weight loss of
    a. $125,000.
    b. $150,000.
    c. $200,000.
    d. $250,000
    e. $300,000

12. If the Public Service Commission implements an optimal two-part pricing plan, the usage fee is set at $_____ per 1,000-gallon units per month and the fixed monthly access charge must then be $_____ per household.
    a. $4.00; $12.00
    b. $4.00; $12.50
    c. $5.00; $12.00
    e. $5.00; $12.50

13. Two-part pricing is a desirable method of pricing water because
    a. it is more profitable for the utility company than average-cost-pricing (i.e., second-best pricing).
    b. deadweight loss is zero.
    c. the deadweight loss is paid for by the users of water.
    d. it easy to implement in practice.
    e. both *a* and *d*

Use the figure below, which shows the linear demand and constant cost conditions facing a firm with a high barrier to entry, to answer questions 14–16.



14. The firm will earn economic profit of $_____.
    a. $500,000
    b. $750,000
    c. $1,000,000
    d. $1,250,000

15. If the entry barrier is removed consumers will be better off because
    a. consumers will enjoy greater consumer surplus.
    b. productive efficiency will be restored.
    c. competition will eliminate the shortage caused by the entry barrier.
    d. all of the above

16. $_____ the deadweight loss is caused by the market power created by the high entry barrier
    a. $625,000
    b. $1,000,000
    c. $1,500,000
    d. $2,000,000

17. An underallocation of resources in an industry means that for the last unit produced,
    a. economic profit is still rising.
    b. society places a higher value on the resources required to produce the last unit than the value society places on consuming the last unit.
    c. the demand price for the last unit exceeds the marginal cost of producing the last unit.
    d. the cost of producing the last unit exceeds its value to society.
    e. long-run average cost is falling.

18. When we say that market prices allocate goods to the highest-valued users, we mean that
    a. Only consumers with higher incomes will get any of the good, while lower income consumers get none of the good.
    b. Only consumers who value the good more than the market price of the good will choose to buy the good.
    c. Government allocation of the good is warranted because government can make sure that the good gets consumed by deserving individuals.
    d. Consumer surplus is maximized.
    e. both *a* and *d*

19. The less accurate consumer information is about product quality,
    a. the greater will be the loss of social surplus due to productive inefficiency.
    b. the smaller will be the loss of social surplus due to productive inefficiency.
    c. the greater will be the loss of social surplus due to allocative inefficiency.
    d. the smaller will be the loss of social surplus due to allocative inefficiency.

20. Private provision of public goods fails to achieve economic efficiency because
    a. the free rider problem causes overproduction of the good.
    b. the free rider problem prevents collection of sufficient revenue.
    c. the price of the privately supplied public good must exceed zero.
    d. both *a* and *c*
    e. both *b* and *c*

Answers

MATCHING DEFINITIONS

1. government failure
2. second-best pricing
3. free-rider problem
4. rationing function of prices
5. abatement
6. nondepletable
7. subadditive
8. unitization
9. positive externality
10. allocative efficiency
11. total abatement cost
12. public goods
13. productive efficiency
14. emission taxes
15. deadweight loss
16. marginal damage
17. marginal-cost-pricing
18. negative externality
19. social economic efficiency
20. common property resources
21. total damages
22. natural monopoly
23. market failure
24. two-part pricing
25. monopoly power

STUDY PROBLEMS

1. a. Find the intersection of demand, D, and long-run industry supply, S. On the graph, the intersection is found at \$1.00 and 10,000 bagels per day. The solution can also be found mathematically by setting Q_d equal to Q_s and solving for market price P_E:

$$15,000 - 5,000P = 10,000P$$

$$P_E = \$1.00$$

Next, substitute \$1.00 into either the demand or supply equation to find equilibrium quantity:

$$Q_E = 15,000 - 5,000(1.00) = 10,000(1.00)$$

$$= 10,000$$

b. Certainly, every bagel producer in Boston knows that in order to maximize the firm's profit, total costs must be minimized. Thus each firm will operate on its expansion path, and productive efficiency results. This argument is more compelling in the long run, because any firm that fails to operate on its expansion path will earn losses and be forced to get out of the bagel business in Boston.

c. At 6,000 units, the marginal benefit to society of an additional bagel is \$1.80, because demand price gives the marginal valuation or benefit to consumers of having an additional bagel. At 6,000 units, the marginal cost of producing another bagel is \$0.60, because competitive supply prices give the marginal cost of producing an additional bagel. Since the marginal benefit exceeds the marginal cost, an increase in bagel consumption and production will increase society's net benefit.

d. At 12,000 units, the marginal cost is \$1.20 and the marginal benefit is \$0.60. Reducing bagel production and consumption by one unit will decrease total cost by \$1.20 and decrease total benefit by \$0.60, which results in a gain in net benefit of \$.60.

e. Since the market price is \$1.00, only consumers with demand prices equal or higher demand prices will choose to purchase bagels. These voluntary buyers are represented by the 10,000 buyers whose demand prices lie on the segment of demand

between \$3 and \$1.00. The lower-valued buyers represented by the segment of demand between \$1.00 and \$0 will voluntarily choose not to buy bagels at the market price of \$1.00, leaving the 10,000 bagels for the higher-valued consumers.

f. Yes, because both productive efficiency and allocative efficiency are achieved at the point of competitive equilibrium, \$1.00 and 10,000 bagels per day.

2. a. Consumer surplus of the 6,000th unit = \$1.80 – \$1.00 = \$0.80

Producer surplus of the 6,000th unit = \$1.00 – \$0.60 = \$0.40

Social surplus of the 6,000th unit = Consumer surplus + Producer surplus = \$1.20

b. At 6,000 units, the total surpluses are equal to areas of trapezoids. Recall that the area of a trapezoid is calculated by multiplying base times the average height of the two sides:

$$\text{Consumer surplus} = 6{,}000 \times \frac{(\$3 - \$1) + (\$1.80 - \$1.00)}{2} = \$8{,}400$$

$$\text{Producer surplus} = 6{,}000 \times \frac{(\$1.00 - \$0) + (\$1.00 - \$0.60)}{2} = \$4{,}200$$

Social surplus = Consumer surplus + Producer surplus = \$12,600

c. At the competitive equilibrium price and quantity, \$1.00 and 10,000 units, respectively:

$$\text{Consumer surplus} = 0.5 \times 10{,}000 \times (\$3 - \$1) = \$10{,}000$$

$$\text{Producer surplus} = 0.5 \times 10{,}000 \times (\$1 - \$0) = \$5{,}000$$

Social surplus = Consumer surplus + Producer surplus = \$15,000

Social surplus in competitive equilibrium (\$15,000) is greater than social surplus at 6,000 units (\$12,600). This is expected since social surplus is maximized at the intersection of demand and supply.

3. a. A shortage equal to 6,000 bagels per day (= 12,000 – 6,000).

b. Consumer surplus with the \$0.60 price ceiling = \$10,800:

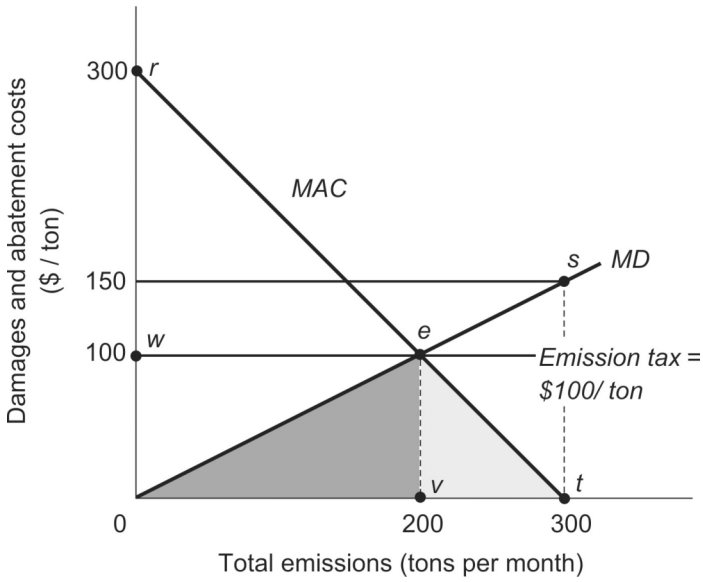
$$6{,}000 \times \frac{(\$3 - \$0.60) + (\$1.80 - \$0.60)}{2}.$$

The 6,000 consumers who are able to buy bagels are better off by \$2,400, which is the amount they save by paying \$0.40 less than the market price. However, those consumers who wanted to buy 4,000 more bagels at \$1.00 are worse off by the amount of the lost consumer surplus on those units: –\$1,600 = 0.5 × 4,000 × (\$1.80 – \$1.00). Thus the net gain in consumer surplus is \$800 (= \$2,400 – \$1,600).

c. Producer surplus with the \$1.00 price ceiling = \$1,800 = 0.5 × 6,000 × (\$0.60 – \$0). All producers are worse off since all sellers receive 40 cents less per bagel and they are selling fewer bagels. The lost producer surplus is \$3,200 (= \$5,000 – \$1,800).

4. The figure on the next page provides answers to various parts of this question.

a. 300 tons per month is the uncontrolled level of pollution. Total damage at 300 tons is \$22,500 per month (= area *0st* = 0.5 × 300 × \$150). Total abatement cost is \$0, because no abatement is undertaken at 300 tons. Total social cost, which is the sum of total damage plus total abatement cost, is \$22,500 (= \$22,500 + \$0).



a. 300 tons per month is the uncontrolled level of pollution. Total damage at 300 tons is $22,500 per month (= area *0st* = 0.5 × 300 × $150). Total abatement cost is $0, because no abatement is undertaken at 300 tons. Total social cost, which is the sum of total damage plus total abatement cost, is $22,500 (= $22,500 + $0).

b. Total abatement cost = $45,000 per month (= area *0rt* = 0.5 × 300 × $300). Total social cost, which is the sum of total damage plus total abatement cost, is $45,000 (= $0 + $45,000).

c. Zero emissions is not optimal because the marginal cost of abating the 300th ton is $300 while the marginal benefit of doing so is $0 (i.e., *MD* = 0 for the 300th ton abated). Therefore, emissions should be increased (and abatement decreased) until *MAC* = *MD* at 200 tons per month.

d. 200; total abatement cost = $5,000 (= area *vte* = 0.5 × 100 × $100); total damage = $10,000 (= area *0ve* = 0.5 × 200 × $100); total social cost = $15,000.

e. Total social cost of pollution is minimized at 200 tons of monthly discharge.

f. The optimal level of abatement for this industry is 100 tons per month, which is the difference between the uncontrolled level of pollution, 300 tons, and the optimal level, 200 tons.

g. $100 per ton; 200 tons per month; $20,000; 100 tons abated; $5,000 (= area *vte*)

5. a. marginal social benefit; demand
   b. $36; 2,000
   c. $18; smaller; $36
   d. $9,000 [= 0.50 x 1,000 x ($36 –$18)]

MULTIPLE CHOICE / TRUE-FALSE

1. d Social economic efficiency requires both productive and allocative efficiency, but this does not imply that consumer surplus is maximized when markets achieve social economic efficiency. It is true, however, that the *sum* of consumer surplus and producer surplus is maximized when markets are efficient.

2. e Only choice *d*, the case of perfectly competitive markets, would not necessarily indicate a likely case of market failure. Of course, perfectly competitive markets can certainly fail, but only if one of the six situations presented in this chapter happen to afflict the competitive market.

3. c At this output level, you can see in the figure that $P = LMC$. Set $P = \$4$ in the inverse demand equation: $4 = 24 - 0.0004Q$. Then solve for Q to get $Q = 50{,}000$.

4. b You are given the inverse demand, so you can write the marginal revenue equation: $MR = 24 - 0.0008Q$. Set $MR = \$4$ and solve for Q to get $Q = 25{,}000$.

5. e $AQFC$ at 50,000 units = $TFQC$ / 50,000. To find TQFC, you can see in the figure that $AQFC = \$10$ at 25,000 units of water $\Rightarrow TQFC = \$250{,}000$.

6. e $LAC = AQFC + LMC = \$5 + \$4 = \$9$

7. c $AQFC$ at 50,000 units = $TFQC$ / 50,000. To find TQFC, you can see in the figure that $AQFC = \$10$ at 25,000 units of water $\Rightarrow TQFC = \$250{,}000$.

8. c Marginal-cost-pricing occurs at \$4 per 1,000-gallon unit of water and 50,000 units of water.

9. d Average-cost-pricing (i.e., second-best pricing) leads to losses, which taxpayers will have to cover in the long run.

10. e Setting $P = \$14$ (= LAC) is the price closest to LMC that allows the utility to break even. At \$14, 25,000 units are demanded. Since \$14; 25,000 is not a choice the answer is *e*.

11. a $DWL = 0.5 \times 25{,}000 \times (\$14 - \$4) = \$125{,}000$

12. b $f^* = \$4$, which creates a loss of \$250,000 [= (\$9–\$5)×50,000]. $A^* = \$250{,}000/20{,}000 = \$12.50$ per household per month.

13. b Remember that profit is zero for two-part pricing and for second-best pricing. Choice *c* is nonsense and choice *d* is incorrect because two-part pricing is rather difficult in practice (witness the complexity of the rate hearings that determine the proper two-part pricing levels).

14. d Construct the MR curve and find the intersection with LMC at 50,000 units of output. Price at 50,000 units is \$75 and LAC at 50,000 units is \$50, thus total profit is $\$25 \times 50{,}000 = \$1{,}250{,}000$.

15. a Only *a* is correct. Monopoly firms are productively efficient, because they must produce on their expansion paths to minimize cost and maximize profit. There is no shortage at the monopoly price of \$75 (for that matter, there is never a shortage under monopoly in any case).

16. a $DWL = 0.5 \times 50{,}000 \times (\$75 - \$50) = \$625{,}000$

17. c Underallocation means that the value of the last unit exceeds the marginal cost of producing the last unit. Only choice *c* is correct.

18. e Both *b* and *d* are correct.

19. c The greater the error in consumer evaluation of product quality, the greater will be the difference between demand price and true marginal social benefit, which creates greater allocative inefficiency.

20. e Market failure in the case of public goods occurs for two reasons: nonexlcudability makes it unprofitable to supply the good and, even if it is supplied, the price cannot be zero (i.e., the marginal cost of providing additional consumers with the good).

Homework Exercises

1. Fill in the blanks with the correct words:

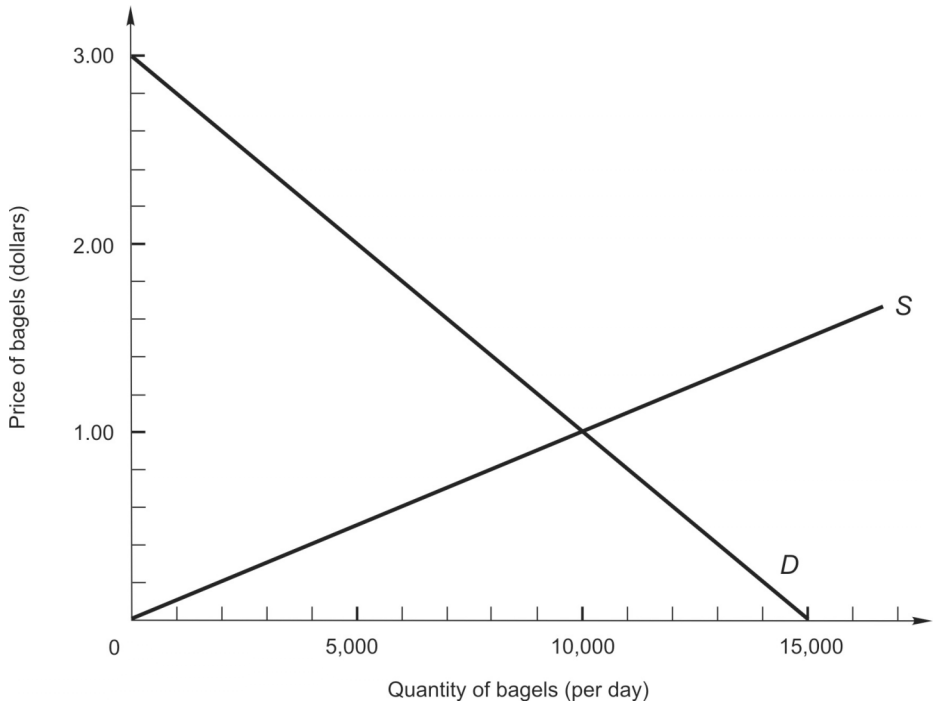
   a. Perfectly competitive markets are desirable from society's point of view because well-functioning competitive markets (i.e., absent market failure) maximize _____ surplus, which is the sum of _____ surplus and _____ surplus. Furthermore, well-functioning competitive markets result in social _____ efficiency, which requires that the market achieve both _____ efficiency and _____ efficiency.

   b. In well-functioning perfectly competitive markets, _____ efficiency is achieved in both the short run and long run because _____ (total, average, marginal) cost is _____ (maximized, minimized).

   c. In well-functioning perfectly competitive markets, _____ efficiency is achieved because the _____ in market equilibrium equals marginal cost.

2. The market for bagels in San Francisco is perfectly competitive. Presently, the daily demand for bagels in San Francisco is $Q_d = 15{,}000 - 5{,}000P$, and the supply of bagels is $Q_s = 10{,}000P$, where P is the price of bagels and quantities Q_d and Q_s, respectively, are the number of bagels bought and sold each day. The figure on the next page shows the demand and supply curves for bagels in San Francisco. Answer the questions that follow.

   a. The competitive equilibrium price of bagels in San Francisco is $_____ and the equilibrium quantity is _____ bagels per day. Show your mathematical solution below and draw the equilibrium in the figure above, labeling the point of equilibrium "*C*."



b. The consumer surplus for the 5,000th bagel is $_____. The producer surplus for the 5,000th bagel is $_____. Show your mathematical work below.

c. In competitive equilibrium in the San Francisco bagel market, total consumer surplus is $_____ and total producer surplus is $_____. Social surplus is $_____. Show your computations below. Shade and label the appropriate areas (i.e., *CS*, *PS*, and *SS*) in the figure above.

Now suppose Einstein Bagels buys every other bagel store in town and forms a bagel monopoly in San Francisco.

d. The monopoly price of bagels is $_____ and the number of bagels bought and sold daily is _____ bagels per day under monopoly. Show your work below and draw the equilibrium in the figure above, labeling the monopoly equilibrium "*M*."

e. The deadweight loss due to the bagel monopoly in San Francisco is $_____. Show your work below: