BOOK 2 – ECONOMICS

READINGS AND
LEARNING OUTCOME STATEMENTS

READINGS

The following material is a review of the Economics principles designed to address the learning outcome statements set forth by CFA Institute.

STUDY SESSION 4

Reading Assignments
Economics, Michael Parkin (Addison Wesley, 2005)

STUDY SESSION 5

Reading Assignments
Economics, Michael Parkin (Addison Wesley, 2005)

STUDY SESSION 6

Reading Assignments
Economics, Michael Parkin (Addison Wesley, 2005)

International Investments, 5th edition, Bruno Solnik and Dennis McLeavey (Addison Wesley, 2004)

LEARNING OUTCOME STATEMENTS (LOS)

STUDY SESSION 4

The topical coverage corresponds with the following CFA Institute assigned reading:

13. **Elasticity**

The candidate should be able to:
   a. define and calculate price elasticity of demand, explain the difference between inelastic and elastic demand, and discuss the different factors that influence the elasticity of demand. (page 10)
   b. explain and calculate other elasticities of demand. (page 12)
   c. define and calculate elasticity of supply, and discuss the different factors that influence the elasticity of supply. (page 14)

The topical coverage corresponds with the following CFA Institute assigned reading:

14. **Efficiency and Equity**

The candidate should be able to:
   a. distinguish between marginal benefit and marginal cost, calculate the efficient quantity, and discuss the associated efficiency and inefficiency. (page 20)
   b. explain consumer surplus and marginal benefit, and how the value of a good or service is calculated. (page 21)
   c. explain the relationship between marginal (or opportunity) cost and the minimum supply price, and define producer surplus. (page 22)
   d. discuss the relationship between consumer surplus, producer surplus and equilibrium. (page 23)
   e. explain how resources move to the most efficient allocation, the obstacles to achieve efficiency, and whether or not competitive markets use resources efficiently. (page 24)
   f. explain the two groups of ideas about the fairness principle in light of the competitive market, and discuss the draw-backs of utilitarianism, and the symmetry principle. (page 25)

The topical coverage corresponds with the following CFA Institute assigned reading:

15. **Markets in Action**

The candidate should be able to:
   a. discuss the impact of price ceilings on equilibrium in the short and in the long run, and supply and demand, and the impact of a price ceiling on the existence of a black market. (page 31)
   b. explain the effects of a minimum wage and the effects when it is set either above or below the equilibrium wage level. (page 32)
   c. discuss the impact of tax, subsidies, quotas, and markets for illegal goods on demand, supply and the market equilibrium. (page 33)

The topical coverage corresponds with the following CFA Institute assigned reading:

16. **Organizing Production**

The candidate should be able to:
   a. explain the different types of opportunity cost and the relationship to economic profit, and calculate economic profit. (page 42)
   b. discuss the firm's constraints and their impact on maximum profit. (page 43)
   c. distinguish between technological and economic efficiency, and discuss under which circumstances a firm is technological or economically efficient. (page 43)
   d. discuss the different ways a firm can organize production, how the principal-agent problem occurs, and which measures a firm can take to reduce the impact of the principal-agent problem. (page 45)
   e. distinguish between the different types of business organization, discuss the advantages and disadvantages of each of the systems both individually and relative to each other. (page 46)

   f.   identify the different market types, and describe the conditions that characterize them. (page 46)

   g.   explain the different ways in which concentration can be measured, and discuss the limitations of concentration measures. (page 47)

   h.   discuss the two ways in which economic activity can be coordinated, and the different ways in which firms are often more efficient than markets. (page 48)

The topical coverage corresponds with the following CFA Institute assigned reading:

17.   **Output and Costs**

The candidate should be able to:

   a.   explain why technology is a constraint on the increase of output in the short-term, how a firm can change output in the short run using the concepts of total, marginal, and average product, and the implication on short-run cost using the concepts of total, marginal, and average cost. (page 53)

   b.   explain the shape of the marginal cost curve and the average total cost curve, and explain the relationships between the different cost curves. (page 57)

   c.   discuss the concepts of diminishing returns and diminishing marginal product of capital. (page 58)

   d.   explain the relationship between the long-run and short-run costs, and the different economies and diseconomies of scale. (page 59)

The topical coverage corresponds with the following CFA Institute assigned reading:

18.   **Perfect Competition**

The candidate should be able to:

   a.   explain why firms in perfect competition are price takers, and discuss the relationship between demand, price and revenue. (page 64)

   b.   discuss how the firm maximizes profit in perfect competition, analyze the marginal costs and revenue, and the concepts of economic profit and loss. (page 65)

   c.   distinguish between the firm's and the industry's short-run supply curve, and explain the relationship between the two. (page 67)

   d.   explain the relationship between the firm's marginal cost, marginal revenue, and price when a firm in perfect competition produces the quantity that maximizes profit. (page 67)

   e.   discuss the impact of changes in demand, long-run adjustments, entry and exit, and changes in plant size on the long-run equilibrium. (page 67)

   f.   discuss how a permanent change of demand or changes in technology impact price, output, and economic profit. (page 68)

The topical coverage corresponds with the following CFA Institute assigned reading:

19.   **Monopoly**

The candidate should be able to:

   a.   discuss the characteristics of a monopoly, how they arise, the key features, and monopoly price strategies. (page 74)

   b.   explain the relationship between price, marginal revenue, and marginal cost for a monopoly. (page 75)

   c.   distinguish between monopoly and perfect competition, explain why a monopoly can set a higher price, and why a monopoly is considered inefficient. (page 75)

   d.   explain the concepts of price discrimination. (page 76)

   e.   discuss the reasons why a monopoly exists, how economies of scope and economies of scale can be achieved, and discuss the issues surrounding regulation of a natural monopoly. (page 77)

The topical coverage corresponds with the following CFA Institute assigned reading:

20. **Monopolistic Competition and Oligopoly**

The candidate should be able to:

a. discuss the characteristics of monopolistic competition, economic profit and loss in the short-run, output and price in the long-run, and discuss whether or not monopolistic competition is efficient. (page 82)

b. explain the differences in product development and marketing in monopolistic competition, the impact of advertising costs on the costs curves, and discuss whether or not advertising and branding is efficient in monopolistic competition. (page 84)

c. discuss the characteristics of an oligopoly, and the traditional oligopoly models. (page 85)

d. explain the prisoners' dilemma, how it can be applied to oligopoly price fixing, and the impact on cost, price, demand, and profits. (page 86)

STUDY SESSION 5

The topical coverage corresponds with the following CFA Institute assigned reading:

21. **Demand and Supply in Factor Markets**

The candidate should be able to:

a. explain the difference between marginal revenue and marginal revenue product. (page 93)

b. discuss how the labor demand curve is derived from the marginal revenue product curve, the conditions of profit maximization, the factors determining the demand and for labor, elasticity of the demand for labor, and labor market equilibrium. (page 93)

c. explain the difference between physical and financial capital, and how the demand for physical and financial capital are related to each other. (page 95)

d. discuss how a firm compares the future marginal revenue product of capital with the current price of capital, and the relationship between the quantity of financial capital demanded and the interest rate. (page 95)

e. discuss the main influences on demand and supply of capital, and capital market equilibrium. (page 95)

f. distinguish between the supply of renewable and non-renewable natural resources, and explain how equilibrium in a natural resource market is achieved. (page 96)

g. explain how differences occur between large and small incomes. (page 97)

h. distinguish between economic rent and opportunity costs. (page 97)

The topical coverage corresponds with the following CFA Institute assigned reading:

22. **Monitoring Cycles, Jobs, and the Price Level**

The candidate should be able to:

a. discuss the phases of the business cycle, how the start and end of a recession can be identified, and interpret the main labor market indicators and the relationship of the labor market indicators with the business cycle. (page 103)

b. discuss the concepts of aggregate hours and real wage rates, and how they relate to GDP. (page 104)

c. discuss the types of unemployment, full employment, and the relationship between unemployment and real GDP. (page 105)

d. explain the construction of the CPI, calculate CPI, discuss the relationship between CPI and the inflation rate, and discuss the problems associated with CPI bias. (page 105)

The topical coverage corresponds with the following CFA Institute assigned reading:

23. **Aggregate Supply and Aggregate Demand**

The candidate should be able to:

a. explain the fundamentals of aggregate supply in the long run and in the short run, and discuss different reasons for changes in aggregate supply and the associated movements along the LAS and SAS curves. (page 112)

b. explain the effects that cause the aggregate demand curve to slope downwards, the main factors influencing aggregate demand, and how changes in these factors influence aggregate demand and the aggregate demand curve. (page 114)

c. discuss the difference between short-run and long-run macroeconomic equilibrium, and explain how the relationship between economic growth, inflation and changes in aggregate demand and aggregate supply influence short- and long-run macroeconomic equilibrium. (page 115)

d. compare and contrast the main schools of macroeconomic thought in relation to aggregate demand and aggregate supply. (page 117)

The topical coverage corresponds with the following CFA Institute assigned reading:

24. **Money, Banks, and the Federal Reserve**

The candidate should be able to:

a. discuss the functions of money, and the problems that arise when using commodities as money. (page 122)

b. compare and contrast the different depository institutions, their economic function, and the impact of financial regulation, deregulation, and innovation. (page 122)

c. explain how banks create money, and calculate the amount of loans a bank can generate, given a certain amount of deposits. (page 124)

d. discuss the goals and targets of the U.S. Fed, the balance sheet, and compare and contrast the policy tools. (page 124)

The topical coverage corresponds with the following CFA Institute assigned reading:

25. **Money, Interest, Real GDP, and the Price Level**

The candidate should be able to:

a. discuss the factors determining the demand for money, define the demand for money curve, and the effects of changes in real GDP and financial innovation on the demand for money curve. (page 128)

b. explain how interest rates are determined, the influence on the money market equilibrium, and the interaction between interest rate changes and the money supply. (page 129)

c. discuss the short-run and long-run effects of money on real GDP. (page 130)

d. explain the quantity theory of money. (page 131)

The topical coverage corresponds with the following CFA Institute assigned reading:

26. **Inflation**

The candidate should be able to:

a. discuss the difference between inflation and price-level, and calculate the inflation rate. (page 135)

b. distinguish between the factors resulting in demand-pull and cost-push inflation, and the impact on price levels, and aggregate demand and supply. (page 135)

c. discuss the effects of unanticipated inflation on the labor market and the market for financial capital. (page 137)

d. distinguish between anticipated and unanticipated inflation, and discuss the adverse effects of anticipated inflation. (page 137)

e. discuss the impact of inflation on unemployment, define the short-run and long-run Phillips curve, and discuss changes in the natural rate of unemployment. (page 138)

f. explain the impact of inflation on the nominal interest rate, and discuss how this is related to the money supply discussed in the previous reading. (page 139)

The topical coverage corresponds with the following CFA Institute assigned reading:

27. **Fiscal Policy**

The candidate should be able to:

a. interpret potential GDP, and the effects of income tax and tax on expenditure on potential GDP. (page 144)

b. discuss the sources of investment sources, and the influence of fiscal policy on capital markets. (page 145)

c. define the generational effects of fiscal policy. (page 146)

d. compare and contrast how the government purchases multiplier, the tax multiplier, the balanced budget multiplier, and discretionary fiscal policy can assist in stabilizing the business cycle. (page 146)

e. discuss the limitations of discretionary stabilizers, and distinguish between discretionary fiscal policy and automatic stabilizers. (page 147)

The topical coverage corresponds with the following CFA Institute assigned reading:

28. **Monetary Policy**

The candidate should be able to:

a. distinguish between price level stability, and sustainable real GDP growth. (page 152)

b. compare and contrast the policies that can be implemented to achieve price level stability. (page 152)

c. discuss policy credibility in relation to aggregate demand and aggregate supply, and the Phillips curve. (page 153)

d. compare and contrast the new Monetarist and new Keynesian feedback rules. (page 156)

STUDY SESSION 6

The topical coverage corresponds with the following CFA Institute assigned reading:

29. **Trading with the World**

The candidate should be able to:

a. discuss opportunity cost associated with trade, how countries can gain from international trade, how countries determine whether to import, export or produce goods and services, and explain the gains of trade for all parties. (page 160)

b. compare and contrast tariffs, non-tariff barriers, quotas and VERs with respect to international trade. (page 162)

c. discuss the advantages and disadvantages of protection for each party, and explain the main reasons for trade restriction. (page 164)

The topical coverage corresponds with the following CFA Institute assigned reading:

30. **International Finance**

The candidate should be able to:

a. explain the different components of the Balance of Payments Accounts, the transactions recorded for import and export on the different accounts, and how the three sector balances are related. (page 168)

b. explain the law of demand and the law of supply for foreign exchange, and how changes in demand and supply occur. (page 169)

c. discuss the influence of supply and demand on the exchange rate, and why exchange rates can be volatile. (page 171)

d. distinguish between purchasing power and interest rate parity. (page 172)

e. discuss how and why intervention by a central bank in the exchange market may be required. (page 172)

The topical coverage corresponds with the following CFA Institute assigned reading:

31. **Foreign Exchange**
The candidate should be able to:
a. define direct and indirect methods of foreign exchange quotations and convert direct (indirect) foreign exchange quotations into indirect (direct) foreign exchange quotations. (page 178)
b. calculate and interpret the spread on a foreign currency quotation and explain how spreads on foreign currency quotations can differ as a result of market conditions, bank/dealer positions, and trading volume. (page 195)
c. calculate and interpret currency cross rates, given two spot exchange quotations involving three currencies. (page 179)
d. distinguish between the spot and forward markets for foreign exchange. (page 181)
e. calculate and interpret the spread on a forward foreign currency quotation and explain how spreads on forward foreign currency quotations can differ as a result of market conditions, bank/ dealer positions, trading volume, and maturity/length of contract. (page 197)
f. calculate and interpret a forward discount or premium and express it as an annualized rate. (page 198)
g. explain interest rate parity and illustrate covered interest arbitrage. (page 198)

The topical coverage corresponds with the following CFA Institute assigned reading:

32. **Foreign Exchange Parity Relations**
The candidate should be able to:
a. explain how exchange rates are determined in a flexible or floating exchange rate system. (page 195)
b. explain the role of each component of the balance-of-payments accounts. (page 195)
c. explain how current account deficits or surpluses and financial account deficits or surpluses affect an economy. (page 196)
d. describe the factors that cause a nation's currency to appreciate or depreciate. (page 196)
e. explain how monetary and fiscal policies affect the exchange rate and balance-of-payments components. (page 197)
f. describe a fixed exchange rate and a pegged exchange rate system. (page 198)
g. discuss absolute purchasing power parity and relative purchasing power parity. (page 198)

ELASTICITY

EXAM FOCUS

Elasticity is a measure of the ratio of the percentage change in one variable to the percentage change in another variable. It is commonly used as a measure of how sensitive the quantity demanded is to changes in the price of a good. After learning all about price elasticity of demand, learn how to apply this concept to calculate and interpret the cross elasticity of demand, the income elasticity of demand, and the elasticity of supply. You must also gain a good understanding of the factors that influence a good's elasticity of demand and elasticity of supply.

LOS 13.a: Define and calculate price elasticity of demand, explain the difference between inelastic and elastic demand, and discuss the different factors that influence the elasticity of demand.

The price elasticity of demand measures the change in the quantity demanded in response to a change in market price (i.e., a movement along a demand curve).

The formula used to calculate the price elasticity of demand is:

$$\text{price elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in price}} = \frac{\%\Delta Q}{\%\Delta P}$$

$$\text{where: percent change} = \frac{\text{change in value}}{\text{average value}} = \frac{\text{ending value} - \text{beginning value}}{\left(\dfrac{\text{ending value} + \text{beginning value}}{2}\right)}$$

Professor's Note: It is customary to use average values when calculating percentage changes used in elasticity computations. This way a change from 8 to 10 and a change from 10 to 8 both result in the same percentage change of $2/9 = 22.2\%$. Use this method on the exam!

Figure 1 illustrates the general categories of price elasticity of demand. A discussion of each is presented below:

* If a *small* percentage price change results in a *large* percentage change in quantity demanded, the demand for that good is said to be *highly elastic*. Apples are an example of an elastic good. The absolute value of price elasticity is greater than one, meaning that the percentage change in Q is greater than the percentage change in P.
* If a *large* percentage price change results in a *small* percentage change in quantity demanded, demand is *relatively inelastic*. Gasoline is an example of a relatively inelastic good. The absolute value of price elasticity is less than one, meaning that the percentage change in Q is less than the percentage change in P.
* A *perfectly elastic* demand curve is horizontal, and its elasticity is infinite. If the price increases, quantity demanded goes to zero.
* A *perfectly inelastic* demand curve is vertical, and elasticity is zero. If the price changes, there will be no change in the quantity demanded.

Figure 1: Price Elasticity of Demand
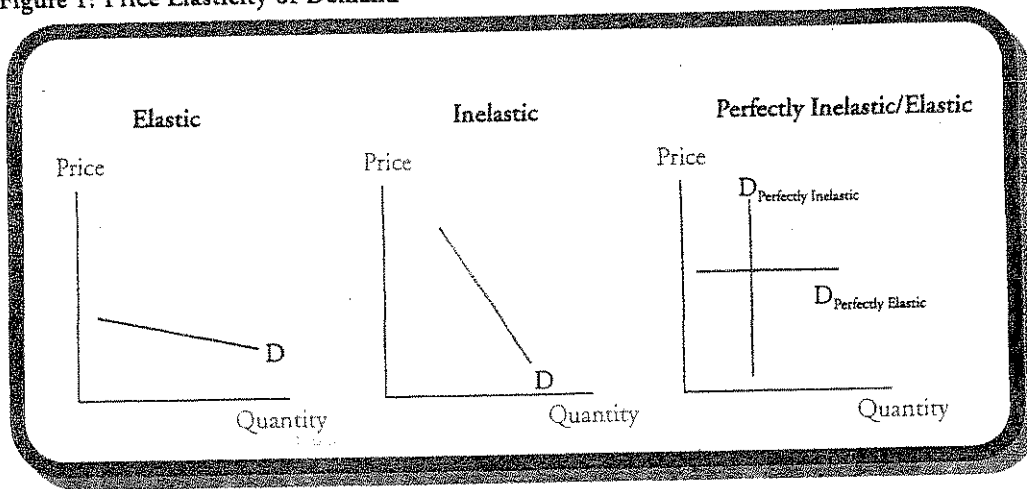
Example: Price elasticity

If the price of product A is increased from $1.00 per unit to $1.10 per unit, the demand will decrease from 5.0 million units to 4.8 million units. Calculate the price elasticity of demand for product A and determine if demand for product A is elastic or inelastic.

Answer:

The percentage change in quantity = [(4.8 − 5.0)] / [(5.0 + 4.8) / 2] = −0.2 / 4.9 = −0.041 = −4.1%. The percentage change in price = [(1.10 − 1.00)] / [(1.10 + 1.00) / 2] = 0.10 / 1.05 = 0.095 = 9.5%. So, the price elasticity of demand for product A is −4.1% / 9.5% = −0.43. Since the absolute value of the price elasticity of demand is less than 1.0, demand for product A is *inelastic*.

Price elasticity of demand is different at different points along a demand curve. Consider the demand curve presented in Figure 2.

Figure 2: Price Elasticity of Demand vs. Location on the Demand Curve
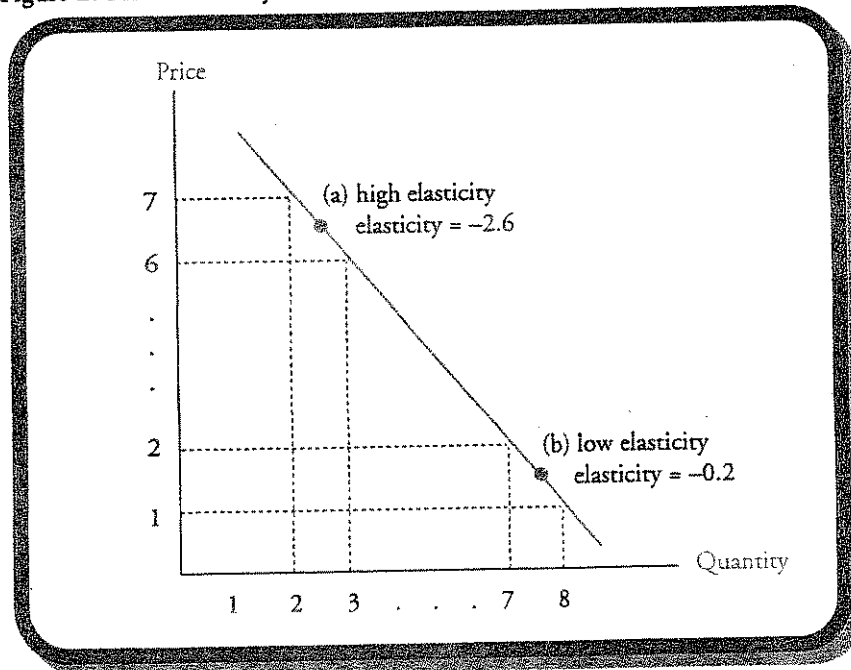
- At point (a), in a higher price range, the price elasticity of the good is greater than at point (b) in a lower price range.
- Price elasticity in the $6 to $7 range is $[(2 - 3) / 2.5] / [(7 - 6) / 6.5] = -2.6$.
- Price elasticity in the $1 to $2 range is $[(7 - 8) / 7.5] / [(2 - 1) / 1.5] = -0.2$

Professor's Note: It is important that you notice that price elasticity of demand changes as you move along the demand curve. Elasticity is not simply the slope of the demand curve!

Factors That Influence the Elasticity of Demand

Price elasticity of demand for a good is primarily determined by three factors: (1) the availability and closeness of substitute goods, (2) the relative amount of income spent on the good, and (3) the time that has passed since the price change of the good.

- *Availability of substitutes.* If good substitutes are available, a price increase in one product will induce consumers to switch to a substitute good. As such, elasticity of demand is determined, in part, by the availability of good substitutes. For example, the demand for gasoline is inelastic (less than one) because it has no practical substitutes, at least in the short run. On the other hand, the price elasticity for beef is high because there are many suitable substitutes, such as fish or chicken.
- *Relative amount of income spent on the good.* When the portion of consumer budgets spent on a particular good is relatively small, demand for that good will tend to be relatively *inelastic.* For example, consider toothpaste versus automobiles. Since people spend a relatively small amount of their incomes on toothpaste, a 10% increase in the price of toothpaste is not likely to change their consumption significantly, if at all. On the other hand, since the cost of an automobile is typically a significant proportion of a person's budget, a 10% increase in car prices may cause annual demand for cars to decrease significantly. Consumers can drive less and do more repairs to keep existing vehicles longer, or they can switch to alternative forms of transportation.
- *Time since the price change.* The price elasticity of demand for most products is greater in the long run than in the short run. Consider the situation in the 1970s when oil and gas prices rose significantly from historical levels. The short-run response was that people simply drove less (picking a closer vacation spot, taking the bus to work, or carpooling) and/or kept their homes at a slightly lower temperature in the winter. Over time, however, other substitutions were made. People bought smaller cars, chose to live closer to work, installed more home insulation, and installed wood burning stoves as an alternative source of heat.

LOS 13.b: Explain and calculate other elasticities of demand.

Two other elasticities of demand are (1) cross elasticity of demand and (2) income elasticity of demand.

Cross elasticity of demand measures the change in the demand for a good in response to the change in price of a substitute or complementary good. The formula for calculating cross elasticity of demand is:

$$\text{cross elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in price of substitute or complement}}$$

When two goods are reasonable substitutes for each other, cross elasticity is positive. On the other hand, cross elasticity is negative when two goods are complements. Complements are goods that are usually used together, so that an increase in the price of one would tend to decrease the quantity demanded of the other. An example would be automobiles and gasoline.

Example: Cross elasticity of demand (substitutes)

Suppose that the price of ice cream at your local ice cream parlor is $1.50 per scoop and 600 scoops per day are sold. Now, assume that at the same parlor, the price of frozen yogurt increases $1.25 to $1.75 per scoop. While nothing else has changed that could affect customers' buying patterns, the sale of ice cream increased from 600 to 750 scoops per day. Calculate the cross elasticity of demand of ice cream relative to frozen yogurt.

Answer:

The average quantity of ice cream demanded is (750 + 600) / 2 = 675 scoops, so the percentage change in th quantity of ice cream demanded is (750 – 600) / 675 = +22.2%. The average price for frozen yogurt is ($1.2 + $1.75) / 2 = $1.50 per scoop, so the percentage change in the price of frozen yogurt is ($1.75 – $1.25) / $1.50 = +33.3%. The cross elasticity of demand for ice cream relative to the price of yog is 22.2 / 33.3 = +0.67.

Professor's Note: For many people, ice cream and frozen yogurt are substitutes, so the cross elasticity of ice cream rela to the price of frozen yogurt is positive.

Example: Cross elasticity of demand (complements)

Suppose that the price of donuts is $0.50 and the local donut shop serves 800 donuts per day. At the s donut shop, the price of coffee is increased from $0.75 to $1.25 per cup. No other changes have occurre the number of donuts sold decreases to 600 per day. Calculate the cross elasticity of demand for donu relative to the price of coffee.

Answer:

The average quantity of donuts demanded is (800 + 600) / 2 = 700, so the percentage change in the of donuts demanded is = (600 – 800) / 700 = –28.6%. The average price for a cup of coffee is ($1.25 – $0. ($0.75 + $1.25) / 2 = $1.00 per cup, so the percentage change in the price of coffee is ($1.25 – $0. $1.00 = 50%. The cross elasticity of demand for ice cream relative to yogurt is –28.6 / 50 = –0.57

Professor's Note: Coffee and donuts are complements, so the cross elasticity of donuts relative to the price of negative.

The **income elasticity of demand** measures the sensitivity of the quantity of a good or service deman change in a consumer's income. The formula for income elasticity of demand is:

$$\text{income elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in income}}$$

Income elasticity of demand is related to the type of good being evaluated. An **inferior** good has n elasticity. As income increases (decreases), quantity demanded decreases (increases). Inferior goods like bus travel and generic margarine. In contrast, a **normal good** has positive income elasticity, wl as income increases (decreases), demand for the good increases (decreases). **Bread** and tobacco ar considered normal goods. Normal goods that have relatively low income elasticities (between 0 a considered *necessities*, while normal goods with high income elasticities (values greater than 1) a considered *luxury goods*.

Example: Income elasticity

Suppose that your income has risen by $10,000 from an initial rate of $50,000. Further, your consumption of bread has increased from 100 loaves per year to 110 loaves per year. Given this information, determine whether bread is a necessity or a luxury good.

Answer:

Your average income is ($50,000 + $60,000) / 2 = $55,000, so the percentage change in income is ($60,000 – $50,000) / $55,000 = 18.2%. Similarly, the average quantity of bread demanded is (100 + 110) / 2 = 105 loaves, so the percentage change in the quantity of bread demanded is (110 – 100) / 105 = 9.5%. Thus, the income elasticity of bread is 9.5/18.2 = 0.52. Since its income elasticity of demand is less than 1.0, bread must be a necessity.

LOS 13.c: Define and calculate elasticity of supply, and discuss the different factors that influence the elasticity of supply.

The price elasticity of supply is similar to the price elasticity of demand. It is a measure of the responsiveness of the quantity supplied to changes in price. That is:

$$\text{price elasticity of supply} = \frac{\text{percent change in quantity supplied}}{\text{percent change in price}} = \frac{\%\Delta Q}{\%\Delta P}$$

As shown in panel (a) of Figure 3 below, a perfectly inelastic (vertical) supply curve has an elasticity of supply of zero. Panel (b) illustrates a perfectly elastic (horizontal) supply curve with an elasticity of supply equal to infinity. For most goods and services, however, the elasticity of supply falls somewhere between these two extremes.

Figure 3: Inelastic and Elastic Supply

(a) Perfectly inelastic supply
(elasticity = 0)

(b) Perfectly elastic supply
(elasticity = ∞)
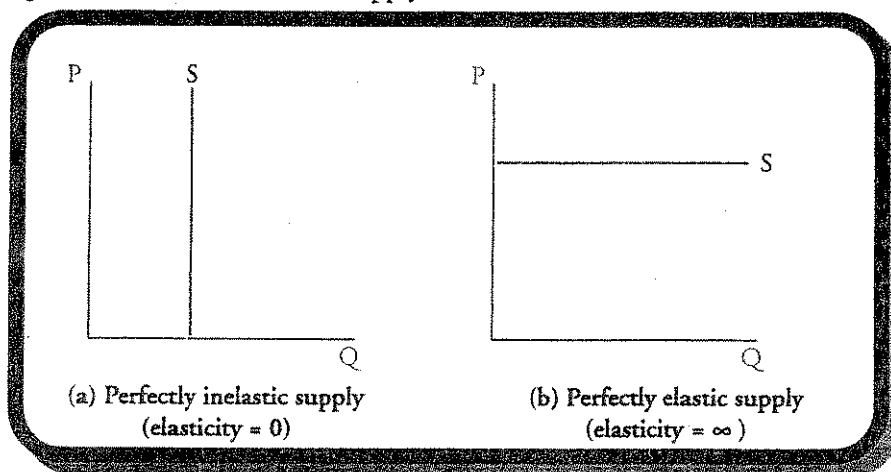
Example: Elasticity of supply

Suppose that the demand curve for coffee increases and that the equilibrium price for a pound of coffee increases from $8 to $10 per pound. At the new price, the quantity supplied increases from 100,000 kilograms per month to 120,000 kilograms per month, although the supply curve has not shifted. Calculate the elasticity of supply for coffee.

Answer:

In this situation, the average quantity of coffee supplied is (100,000 + 120,000) / 2 = 110,000 kilograms, and the average price of coffee is ($8 + $10) / 2 = $9 per pound. So, the percentage change in quantity is (120,000 – 100,000) / 110,000 = 18.18% and the percentage change in price is (10 – 8) / 9 = 22.22%. Thus, the elasticity of supply is 18.18 / 22.22 = 0.82.

Factors that influence the elasticity of supply are: (1) the available substitutes for resources (inputs) used to produce the good and (2) the time that has elapsed since the price change.

Available resource substitutions. When a good or service can only be produced using unique or rare inputs, the elasticity of supply will be low. That is, the short-run supply curve may be nearly vertical for these goods. On the other hand, consider agricultural goods such as sugar and rice. These goods can be grown using the same land (resources), and the opportunity cost of substituting one for the other is nearly constant. As such, both of these products have highly elastic (nearly horizontal) supply curves.

Supply decision time frame. Three time-dependent supply curves must be considered when evaluating how the length of time following a price change affects the elasticity of supply: (1) momentary supply, (2) short-term supply, and (3) long-term supply.

1. *Momentary supply* refers to the change in the quantity of a good supplied immediately following the price change. When producers cannot change the output of a good immediately, the momentary supply curve is vertical or nearly vertical, and the good is highly inelastic. Grapes and oranges are examples of goods for which the quantity produced cannot be immediately changed in response to price changes. On the other hand, goods such as electricity have nearly perfectly elastic momentary supply curves. No matter what the demand for electricity, the amount provided can be changed without a significant change in price.

2. *Short-term supply* refers to the shape a supply curve takes on as the sequence of long-term adjustments are made to the production process. For example, manufacturing firms will adjust the amount of labor they use in response to a price change. The resulting increase or decrease in the cost of this input changes the shape of the supply curve. As time passes, additional adjustments may be made, such as technological innovations and training new workers, which will further change the shape of the supply curve, making it more elastic the longer the adjustment period.

3. *Long-term supply* refers to the shape of the supply curve after all of the possible ways of adjusting supply have been employed. This is usually a lengthy process. It may involve building new factories or distribution systems, and training workers to operate them. Typically, long-term supply is more elastic than short-term supply, which is more elastic than momentary supply.

KEY CONCEPTS

1. Price elasticity of demand measures the change in the quantity demanded in response to a change in market price.

    $$\text{price elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in price}} = \frac{\%\Delta Q}{\%\Delta P}$$

    where %Δ uses average values

2. Price elasticity of demand for a good is primarily determined by three factors: (1) the relative attractiveness of substitute goods, (2) the relative proportion of income spent on the good, and (3) the time that has passed since the price change occured.

3. Cross elasticity of demand measures the change in the demand for a good in response to a change in the price of another good. The formula for calculating cross elasticity of demand is:

    $$\text{cross elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in price of substitute or complement}}$$

4. Cross elasticity of demand is positive for goods that are substitutes for each other, and negative for goods that are complements.

5. Income elasticity of demand measures the sensitivity of the quantity demanded to an increase or decrease in a consumer's income. The formula for income elasticity of demand is:

    $$\text{income elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in income}}$$

6. Inferior goods have negative income elasticities and normal goods have positive income elasticities. Normal goods that have income elasticities between 0 and +1 are considered necessities, while normal goods with income elasticities greater than +1 are generally considered luxury goods.

7. The price elasticity of supply is a measure of the responsiveness of the quantity supplied to changes in price.

    $$\text{price elasticity of supply} = \frac{\text{percent change in quantity supplied}}{\text{percent change in price}}$$

8. Elasticity of supply is influenced by the time frame within which the supply decision is made and by the ability to make substitutions between productive resources.

CONCEPT CHECKERS: ELASTICITY

1. If the number of ice cream bars demanded increases from 19 to 21 when the price decreases from $1.50 to $0.50, the price elasticity of demand is:
    A. −5.
    B. −0.2.
    C. −0.1.
    D. 1.

2. If quantity demanded increases 20% when the price drops 2%, this good exhibits:
    A. elastic, but not perfectly elastic demand.
    B. inelastic, but not perfectly inelastic demand.
    C. perfectly elastic demand.
    D. perfectly inelastic demand.

3. The primary factors that influence the price elasticity of demand for a product are:
    A. changes in consumers' incomes, the time since the price change occurred, and the availability of substitute goods.
    B. changes in consumers' price expectations, changes in consumers' incomes, and the expected time until the price change will occur.
    C. the proportions of consumers' budgets spent on the product, the size of the shift in the demand curve for a product, and changes in consumers' price expectations.
    D. the availability of substitute goods, the time that has elapsed since the price of the good changed, and the proportions of consumers' budgets spent on the product.

4. If a good has elastic demand, a small percentage price increase will cause:
    A. no change in the quantity demanded.
    B. a smaller percentage increase in the quantity demanded.
    C. a larger percentage decrease in the quantity demanded.
    D. a larger percentage increase in quantity demanded.

5. The cross elasticity of demand for a substitute good and the income elasticity for an inferior good are:

	Cross elasticity	Income elasticity
A.	< 0	> 0, < 1
B.	< 0	< 0
C.	> 0	> 0, < 1
D.	> 0	< 0

6. Income elasticity is defined as the percentage change in:
    A. quantity demanded divided by the percentage change in income.
    B. income divided by the percentage change in the quantity demanded.
    C. quantity demanded divided by the percentage change in the price of the product.
    D. the price of a product divided by the percentage change in the quantity demanded.

7. If quantity demanded for a good rises 20% when incomes rise 2%, the good is a(n):
    A. necessity.
    B. luxury good.
    C. inferior good.
    D. inelastic good.

8. When household incomes go up and the quantity of a product demanded goes down, the product is a(n):
   A. necessity.
   B. luxury good.
   C. inferior good.
   D. normal good.

9. If the price elasticity of demand is −2 and the price of the product decreases by 5%, the quantity demanded will:
   A. decrease 2%.
   B. decrease 10%.
   C. increase 5%.
   D. increase 10%.

10. Which of the following is *most likely* a factor that influences the elasticity of supply for a good?
    A. The price of the productive resources used to produce it.
    B. The proportion of consumers' budgets spent on the good.
    C. The availability of substitute productive resources.
    D. The price elasticity of demand for the good.

ANSWERS – CONCEPT CHECKERS: ELASTICITY

1. C   If the number of widgets demanded changes from 19 to 21 when the price changes from $1.50 to $0.50, the percentage change in quantity is $(21 - 19) / [(21 + 19) / 2] = 10\%$ and the percentage change in price is $(0.50 - 1.50) / [(1.50 + 0.50) / 2] = -100\%$. Thus, price elasticity $= 10\% / -100\% = -0.1$.

2. A   If quantity demanded increases 20% when the price drops 2%, this good exhibits elastic demand. Whenever demand changes by a greater percentage than price, demand is considered to be elastic.

3. D   The three primary factors influencing the price elasticity of demand for a good are the availability of substitute goods, the proportions of consumers' budgets spent on the good, and the time since the price change. If there are good substitutes, when the price of the good goes up, some customers will switch to substitute goods. For goods that represent a relatively small proportion of consumers' budgets, a change in price will have little effect on the quantity demanded. For most goods, the price elasticity of demand is greater in the long run than in the short run.

4. C   If a good has elastic demand, a small price increase will cause a larger decrease in the quantity demanded. Demand is elastic when the percentage change in quantity demanded is larger than the percentage change in price.

5. D   The cross elasticity of substitutes is positive and the income elasticity of an inferior good is negative.

6. A   Income elasticity is defined as the percentage change in quantity demanded divided by the percentage change in income. Normal goods have positive values for income elasticity and inferior goods have negative income elasticity.

7. B   A luxury good is a good for which the percentage increase in quantity demanded is greater than the percentage increase in income. A necessity is a good for which, when income increases by a given percentage, the quantity demanded increases, but by a smaller percentage. Since quantity demanded rose 20% when incomes rose 2%, the good in question is a luxury good.

8. C   When household incomes increase and the quantity demanded of a good decreases, the product is an inferior good. Examples of inferior goods are bus travel and margarine (for some income ranges).

9. D   If the price elasticity of demand is –2, and the price of the product decreases by 5%, the quantity demanded will increase 10%. The value, –2, indicates that the percentage increase in the quantity demanded will be twice the percentage decrease in price.

10. C   The factors that influence the elasticity of supply are the possible resource substitutes and the time frame for the supply decision.

EFFICIENCY AND EQUITY

EXAM FOCUS

The primary focus of this review is the efficient allocation of resources. The concepts of marginal benefit, marginal cost, consumer surplus, and producer surplus are all central to understanding the efficient allocation of productive resources. A basic understanding of the obstacles to the efficient allocation of resources and of the two schools of thought on economic "fairness" should be sufficient.

LOS 14.a: Distinguish between marginal benefit and marginal cost, calculate the efficient quantity, and discuss the associated efficiency and inefficiency.

Marginal benefit is the benefit an individual gets from consuming an additional unit of a good or service. Marginal benefit is quantified as the maximum price that a consumer is willing to pay for one additional unit of a good or service. In most cases, the marginal benefit of a good or service decreases as the quantity consumed increases. For instance, the amount a consumer is willing to pay for a piece of cheesecake decreases as the number of pieces of cheesecake consumed over a given period increases. This concept is known as the *principle of decreasing marginal benefit* or *diminishing marginal utility.*

Marginal cost is the cost of producing one more unit of output. Marginal cost is referred to as an *opportunity cost* because it represents the value (in their next-highest-valued use) of the resources required to produce an additional unit of output. For example, the cost to a baker of providing an additional cheesecake is the value of whatever is the next most valuable product that could be produced with the ingredients and labor required to make the cheesecake. Perhaps, a cherry pie.

Figure 1 illustrates the marginal cost (MC) and marginal benefit (MB) curves for cheesecakes and three possible situations: (1) the marginal benefit is greater than marginal cost, (2) the marginal benefit is less than marginal cost, and (3) the marginal benefit equals marginal cost. Let's examine each of these situations.

Marginal benefit > marginal cost. Referring to the marginal benefit curve in Figure 1, we can see that when the quantity of cheesecakes produced is 1,000 per day, the marginal benefit is $30, which means that a consumer is willing to pay $30 for the 1,000th cheesecake offered for sale.

From the marginal cost curve in Figure 1, we see that the cost of producing the 1,000th cheesecake is $10, which is $20 less than the marginal benefit of the 1,000th cheesecake. This means that if the 1,000th cheesecake is baked, consumers are willing to pay $20 more than the baker's cost of producing it. In other words, the value of the 1,000th cheesecake to consumers exceeds the value of the goods or services that must be forgone by the baker to produce the 1,000th cheesecake. In this situation, more value is created by using resources to increase the production of cheesecakes and decrease the production of other goods. The efficient quantity of cheesecakes is the output for which the marginal benefit equals the marginal cost. In Figure 1, we see that this occurs at a production level of 2,000 cheesecakes.

Marginal benefit < marginal cost. From the marginal benefit curve in Figure 1, we can see that consumers are willing to pay only $10 for the 3,000th cheesecake; the marginal benefit to society of the 3,000th cheesecake is $10. The marginal cost curve in Figure 1 shows that the cost of producing the 3,000th cheesecake is $30, which is $20 more than its marginal benefit. The value of the goods and services that must be forgone to produce the

3,000th cheesecake is $20 more than what consumers are willing to pay for it. In this situation, more value will be created by reducing the quantity of cheesecakes produced and reallocating the resources to the production of other goods.

Marginal benefit = marginal cost. At the quantity of production where the marginal cost equals marginal benefit, the total value created by producing a good is at a maximum. We refer to this as the optimal quantity of production and say that productive resources are being allocated efficiently. In terms of our simple example, the 2,001st cheesecake will require resources that are more highly valued when used for production of other goods, while the value in other production of the resources required to produce the 1,999th cheesecake is less than their value when used to produce a cheesecake.

Figure 1: The Efficient Quantity of Cheesecake
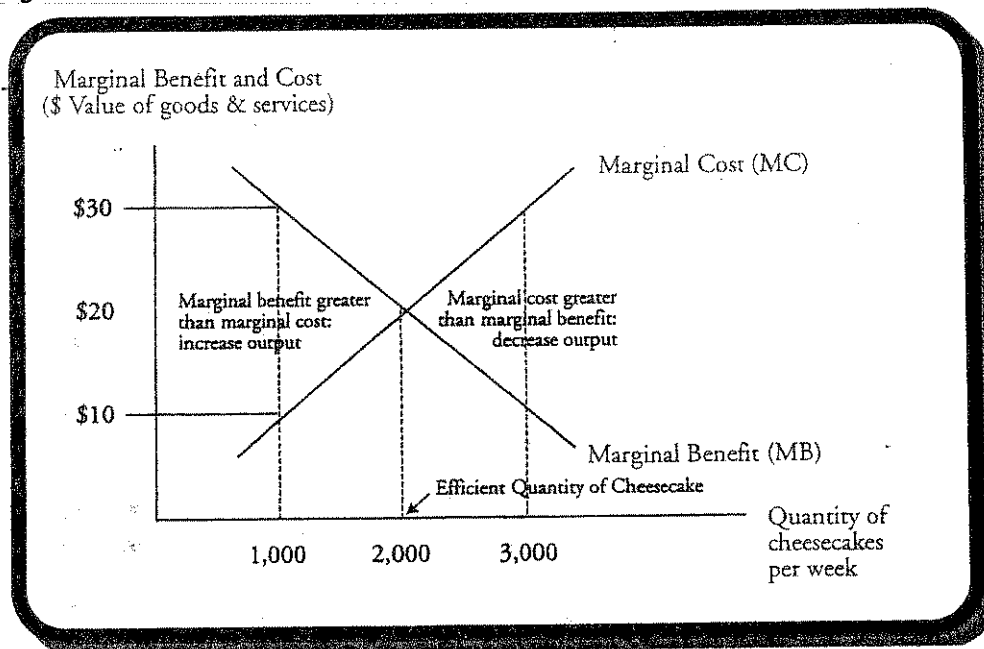
LOS 14.b: Explain consumer surplus and marginal benefit, and how the value of a good or service is calculated.

The value, or marginal benefit, that we derive from a good or service is often greater than the amount we have to pay for it. **Consumer surplus** is the difference between the total value consumers place on the quantity of a good produced and the total amount they must pay for that quantity. For an individual, consumer surplus is defined as the sum of the differences between what that individual is *willing to pay* for each individual unit of a good or service that he or she consumes and the amount that she *actually pays* for each of these units.

Consumer surplus depends on consumers' demand (marginal benefit) curves. For example, at a given market price, the consumer surplus for the third slice of cheesecake to a cheesecake lover will be greater than the consumer surplus for the average cheesecake consumer. This situation is described in Figure 2 where the weekly cheesecake demand (marginal benefit) is depicted for a cheesecake lover named Juan. In Figure 2, we see that the market price for a slice of cheesecake is $5.00 and that Juan is willing to pay $7.00 for one slice per week. This means that Juan's consumer surplus from the first slice of cheesecake is $7.00 − $5.00 = $2.00. Assuming Juan buys five slices of cheesecake in one week, the consumer surplus to Juan is the sum of the consumer surpluses generated by the consumption of each of these five slices. This is represented by the more darkly shaded area in Figure 2. Note that Juan gains no consumer surplus from consuming the fifth piece. He values it at $5.00, an

amount just equal to its price. To determine Juan's weekly consumer surplus, we can calculate this area. For Juan, consumer surplus for five slices of cheesecake is:

$$(\$7.00 - \$5.00) + (\$6.50 - \$5.00) + (\$6.00 - \$5.00) + (\$5.50 - \$5.00) + (\$5.00 - \$5.00) = \$5.00$$

Figure 2: Juan's Demand for Cheesecake and Consumer Surplus
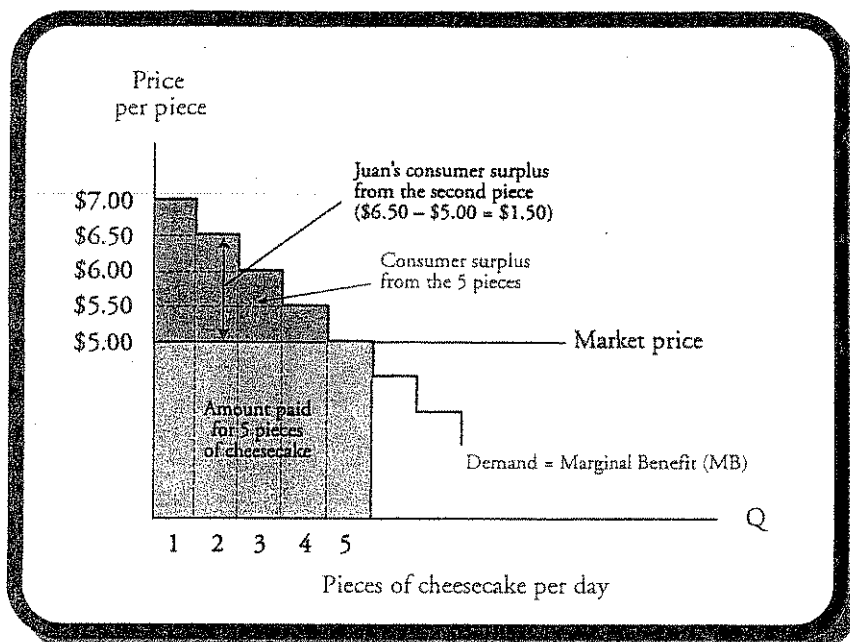
LOS 14.c: Explain the relationship between marginal (or opportunity) cost and the minimum supply price, and define producer surplus.

The concepts of marginal (opportunity) cost, minimum supply price, and producer surplus parallel the concepts of marginal benefit (value), price, and consumer surplus.

For producers of goods and services, marginal cost is the value of the alternatives that producers forego to provide a given good or service, whereas price is what they receive for the good or service when it is sold. Marginal cost is the opportunity cost (value of the foregone opportunity) of producing an additional unit of a good. This is the minimum price, or *minimum supply price*, that producers must receive in order for them to willingly supply an additional unit of a good. It is this minimum acceptable price that determines the quantity that producers supply. Just as the marginal benefit curve is equal to the demand curve for a good or service, the *marginal cost curve for a good or service is the same as the supply curve for that good or service.*

Whenever the market price for a good or service exceeds the marginal cost of producing it, producers realize a producer surplus. Producer surplus is formally defined as the sum of the differences between the price received for each unit of good produced and the opportunity cost of each unit for the total units produced.

Producer surplus is illustrated in Figure 3 for a given bakery's supply (marginal cost) curve for cheesecakes. From this cheesecake supply curve, we see that the minimum supply price (marginal cost) for the bakery to produce the 2,000th cheesecake is $20. Note in Figure 3 that the marginal cost of the 1,000th cheesecake is $10 and that the producer surplus from the 1,000th cheesecake is $20 – $10 = $10. Assume that $20 is the equilibrium market price for cheesecakes. So, for this bakery, producer surplus is the sum of the producer surpluses associated with each cheesecake produced up to the 2,000th cheesecake produced. Producer surplus is represented by the shaded triangular area above the supply curve (and below the price of $20) in Figure 3. The area below the supply curve in Figure 3 represents the firm's opportunity cost of producing 2,000 cheesecakes.

Figure 3: Producer Surplus, Supply, and Marginal Cost
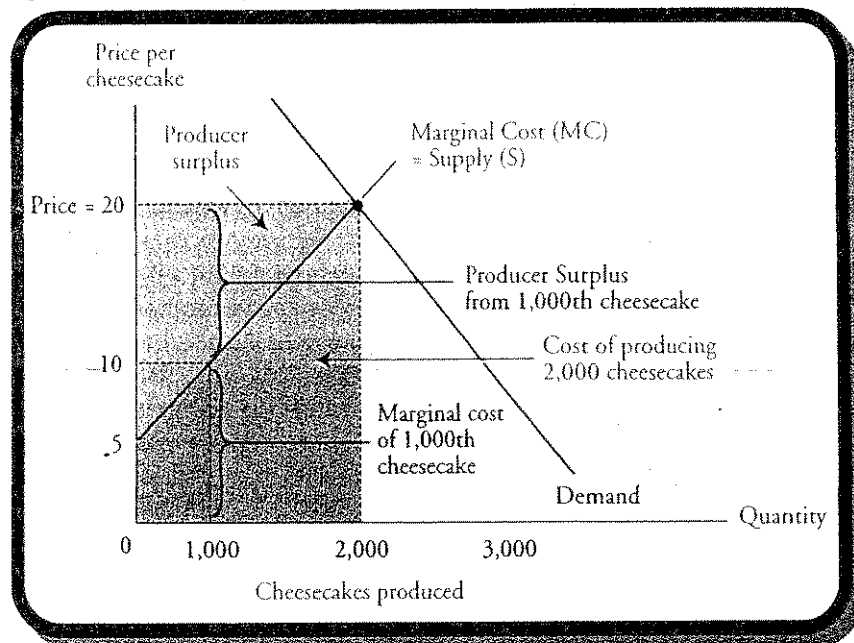
LOS 14.d: Discuss the relationship between consumer surplus, producer surplus and equilibrium.

When the marginal benefit from a good or service is aggregated among all consumers in the market, the resulting marginal benefit curve is called the **marginal social benefit** (MSB) curve and is the market demand curve. Similarly, if the individual marginal cost curves are aggregated among all producers, the resulting marginal cost curve is referred to as the **marginal social cost** (MSC) curve and is the market supply curve.

Given the MSB (market demand) and MSC (market supply) curves for a given product in a competitive market, the equilibrium price and quantity for the product will be determined by the intersection of the MSB and MSC curves. *At this equilibrium price and quantity, the sum of the consumer and producer surpluses is at a maximum.* This is illustrated in Figure 4. The point here is that in competitive markets, when the equilibrium quantity of each good is produced, the economic gains to society are maximized. Resources will be allocated to the production of all goods in such a way as to maximize the total value to society of the economy's production.

Figure 4: Consumer and Producer Surpluses at Equilibrium
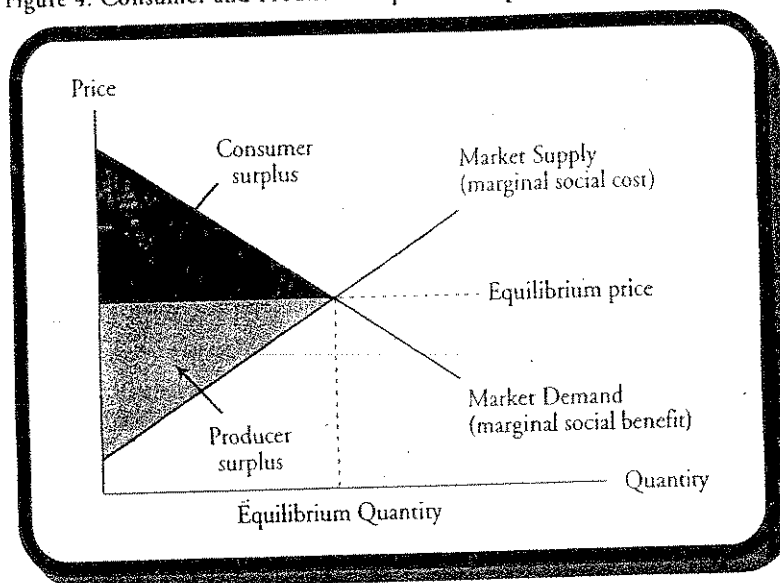
LOS 14.e: Explain how resources move to the most efficient allocation, the obstacles to achieve efficiency, and whether or not competitive markets use resources efficiently.

We can examine how the allocation of resources moves toward their highest-valued use by looking at the example of microwave ovens. Upon their market introduction, microwave ovens were expensive and were primarily sold to restaurants. As technological advances in production reduced the cost of producing microwave ovens, supply increased and prices fell. The (equilibrium) quantity demanded increased, resulting in more resources being devoted to the production of microwave ovens. These resources were removed from the production of other goods and services where the value of what they could produce was less than the value of the microwave ovens that they could produce. Changes in consumer tastes and advances in technology lead to a constant reallocation of productive resources in an economy from one use to another, as the maximum benefit to society can be achieved by the production of a different mix of goods and services.

Adam Smith, considered the father of economics, wrote of the individual in an economy in his 1776 book, *The Wealth of Nations*: "He generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. By preferring the support of domestic to that of foreign industry, he intends only his own security; and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, *led by an invisible hand to promote an end which was no part of his intention*...By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it."

Two centuries later, in the 1987 movie *Wall Street*, the character Gordon Gecko famously said, "The point is, ladies and gentleman, that greed—for lack of a better word—is good." While the language is quite different, the sentiment is the same. By pursuing their own self-interests, workers, consumers, and producers produce and consume an amount and mixture of goods and services that maximizes the overall benefit to society of economic production and consumption. When markets are competitive, unconstrained, and well functioning, the resulting mix of goods and services produced is the optimal one, and the allocation of productive resources is efficient. It is as if people were guided by an "invisible hand" to serve society's interests instead of their own.

There are, however, obstacles to this idealized view of the operation of competitive markets. Some of the obstacles to the efficient allocation of productive resources are:

- **Price controls**, such as price ceilings and price floors, distort the incentives of supply and demand, leading to levels of production different from those of an unregulated market. Rent control and a minimum wage are examples of a price ceiling and a price floor.
- **Taxes and trade restrictions**, such as subsidies and quotas, also impede the natural process toward the efficient allocation of resources. *Taxes* increase the price that buyers pay and decrease the amount that sellers receive. *Subsidies* are government payments to producers that effectively increase the amount sellers receive and decrease the price buyers pay, leading to production of more than the efficient quantity of the good. *Quotas* are government-imposed production limits, resulting in production of less than the efficient quantity of the good. All three lead markets away from producing the quantity for which marginal cost equals marginal benefit.
- **Monopoly** refers to a situation where there is a single seller of a particular good or service. A single seller will choose a (profit-maximizing) quantity of production that is less than the efficient level of production.
- **External costs** are costs imposed on others by the production of goods, and they are not taken into account in the production decision. An example of an external cost is the cost imposed on fishermen by a firm that pollutes the ocean as part of its production process. The firm does not necessarily consider the resulting decrease in the fish population as part of its cost of production, even though this cost is borne by the fishing industry and society. In this case, the output quantity of the polluting firm is greater than the efficient quantity. The societal costs are greater than the direct costs of production the producer bears. The result is an over-allocation of resources to production by the polluting firm.
- **External benefits** are benefits of consumption enjoyed by people other than the buyers of the good and are not taken into account in buyers' consumption decisions. An example of an external benefit is the development of a tropical garden on the grounds of an industrial complex that is located along a busy thoroughfare. The developer of the grounds only considers the marginal benefit to the firms within the complex when deciding whether to take on the grounds improvement, not the benefit received by the travelers who take pleasure in the view of the garden. External benefits result in demand curves that do not represent the societal benefit of the good or service, so that the equilibrium quantity produced and consumed is less than the efficient quantity.
- **Public goods and common resources**. *Public goods* are goods and services that are consumed by people regardless of whether or not they paid for them. National defense is a public good. If others choose to pay to protect a country from outside attack, all the residents of the country enjoy such protection, whether they have paid for their share of it or not. Competitive markets will produce less than the efficient quantity of public goods because each person can benefit from public goods without paying for their production. This is often referred to as the "free rider" problem. A *common resource* is one which all may use. An example of a common resource is an unrestricted ocean fishery. Each fisherman will fish in the ocean at no cost and will have little incentive to maintain or improve the resource. Since individuals do not have the incentive to fish at the economically efficient (sustainable) level, over-fishing is the result. Left to competitive market forces, common resources are generally over-used and production of related goods or services is greater than the efficient amount.

LOS 14.f: Explain the two groups of ideas about the fairness principle in light of the competitive market, and discuss the draw-backs of utilitarianism, and the symmetry principle.

Two schools of thought regarding the fairness of the efficient allocation of resources in a competitive market focus on whether the results of the allocation of resources are fair and on whether the rules of the economic allocation of resources are fair.

One school of economic thought regarding efficient resource allocation is based on the general idea that it is not fair that individuals have dramatically different incomes. For instance, this school of thought contends that it is not fair that the CEO of a firm earns a significantly higher income than the common laborer. From within this framework, some early economists believed in the idea of utilitarianism—that the value of an economy is

maximized when each person owns an equal amount of the resources. This early belief in utilitarianism has been proven wrong, but it warrants a closer look.

Utilitarianism is an idea that proposes that the greatest good occurs to the greatest number of people when wealth is transferred from the rich to the poor to the point where everyone has the same wealth. Proponents of utilitarianism argue that: (1) everyone wants and needs the same things and has the same capacity to enjoy life, and (2) the marginal benefit of a dollar is greater for the poor than the rich, so the gain in marginal benefit to the poor from a transfer of wealth is greater than the loss of marginal benefit to the rich. Since more is gained than lost, the end result after the wealth transfer is that the total combined marginal benefit of the rich and the poor will be greater.

The biggest problem with the utilitarian concept is the trade-off between fairness and efficiency resulting from the cost of executing the utilitarian wealth transfer. The most important criticism of utilitarianism is based on the following argument. Wealth can be transferred from high income earners to low income earners by taxing the high income earners. This will cause the high income earners to work less, resulting in a less-than-efficient quantity of labor being supplied. Further, the taxation of income earned from capital investments will lead to reduced savings and investment. The end result is that the quantities of both labor and capital will decrease, and the economy will shrink in absolute size.

A second source of inefficiency associated with transferring wealth from the rich to the poor through taxation is administrative costs. Taxation involves costs of collecting taxes and auditing returns to enforce compliance. There is significant time and effort devoted to calculating taxes by taxpayers. Welfare agencies have significant administrative costs, which also reduce the amount of the actual transfer. All of the resources and labor used in these activities could be used to produce other goods and services that have value to consumers.

A second school of economic thought is based on the **symmetry principle**. The symmetry principle holds that people in similar situations should be treated similarly. It is basically a moral principle that advocates treating other people the way you prefer to be treated. Economically speaking, this means equality of opportunity.

In *Anarchy, State, and Utopia* (1974), Robert Nozick argues that results are irrelevant to the idea of fair resource allocation—fairness must be based on the fairness of the rules. He suggests that fairness adhere to two rules: (1) governments must recognize and protect private property, and (2) private property must be given from one party to another only when it is voluntarily done. Rule (1) means that everything that is valuable must be owned by individuals, and the government must enforce private property rights. Rule (2) means that the only way an individual can acquire property is through its exchange for something else that he or she owns (including his or her own labor).

Nozick argues that if these uniquely fair rules are followed, the result will be fair. It doesn't matter if the whole economy is shared equally, as long as it is constructed by the same individuals, each of whom provides services on a voluntary basis in exchange for economic benefit. This is what is meant by symmetry—individuals get goods and services from the economy that are equal in value to their contributions to the economy.

KEY CONCEPTS

1. Marginal benefit is the benefit that a consumer gets from the consumption of an additional unit of a good or service.
2. Marginal cost is the cost that a producer incurs to produce one more unit of output. Marginal cost is an opportunity cost because it represents the value of what the productive resources used to produce one more unit of a good could produce in their next highest-valued use.
3. Consumer surplus is the difference between the total value to consumers of the quantity of a good or service consumed and the total amount consumers pay for that production.
4. Minimum supply price is the marginal cost of production.
5. Producer surplus is the difference between the total cost of producing the output of a good or service and the total amount received for that output.
6. The equilibrium quantity produced and consumed in well-functioning unregulated competitive markets is the quantity for which the sum of consumer surplus and producer surplus is maximized.
7. Obstacles to the efficient allocation of resources include price controls, taxes and trade restrictions, monopoly, external costs and benefits, and public goods and common resources.
8. Utilitarianism refers to the idea that the greatest good occurs to the greatest number of people when wealth is transferred from the rich to the poor in order to make everyone's wealth equal.
9. Symmetry is an economic concept based on the idea that what an individual receives from the economy is equal to his contribution and is based on fairness of opportunity, not equality of results.

CONCEPT CHECKERS: EFFICIENCY AND EQUITY

1. If you are willing to pay $20 for a shirt but you only have to pay $16, the $4 difference is:
    A. consumer surplus.
    B. consumer deficit.
    C. producer deficit.
    D. producer surplus.

2. The marginal benefit from consuming the third unit of a product is $12, and the marginal cost to the producer of the third unit is $8. Under these circumstances, which of the following statements is *most accurate?*
    A. Consumer surplus is maximized.
    B. Producer surplus is maximized.
    C. The efficient quantity is less than three.
    D. Producing and selling the third unit will increase efficiency.

3. The idea that a competitive market allocates resources fairly as long as the same rules apply to all participants is suggested by:
    A. utilitarianism.
    B. the fairness principle.
    C. the symmetry principle.
    D. proponents of the equality of outcomes.

4. In an unregulated competitive market, which of the following conditions *most accurately* describes the condition that exists when the efficient quantity of a good or service is produced and consumed?
    A. Producer surplus is maximized.
    B. Consumer surplus is maximized.
    C. Consumer surplus equals producer surplus.
    D. The sum of consumer surplus and producer surplus is maximized.

5. Producer surplus is *best defined* as the:
    A. number of units by which the supply is greater than the quantity demanded by consumers.
    B. the sum of the differences between the price of each unit of a good and its opportunity cost.
    C. difference between the price a consumer pays for a good and the price she is willing to pay for it.
    D. amount by which the price of the next unit of a good exceeds the consumer's marginal benefit from the good.

6. Which of the following statements *most accurately* describes what will occur in an unrestricted economy when tastes change so that marginal benefit exceeds marginal cost at the current quantity produced and sold of a good or service?
    A. The quantity consumed will decrease.
    B. The quantity of the good or service produced will increase.
    C. The quantity of other goods and services produced will increase.
    D. Both the quantity produced and the quantity consumed will remain unchanged.

7. All of the following are obstacles to the efficient allocation of resources EXCEPT:
    A. price deregulation.
    B. monopoly producers.
    C. taxes, quotas and subsidies.
    D. public goods and common resources.

8. As the demand (marginal benefit) curve becomes less elastic, if the equilibrium price and quantity remain unchanged, consumer surplus:
   A. decreases.
   B. increases.
   C. remains unchanged.
   D. it is not possible to determine with the information provided.

ANSWERS – CONCEPT CHECKERS: EFFICIENCY AND EQUITY

1. A   If you are willing to pay $20 for a shirt but you only pay $16 for the shirt, the $4 difference is consumer surplus. The consumer surplus plus the market price equals the total value of the product to the consumer.

2. D   When marginal benefit exceeds marginal cost, increasing the quantity of the good produced improves allocative efficiency.

3. C   The symmetry principle holds that people in similar situations should be treated similarly. It implies that the market allocates resources fairly if the rules that markets operate by are equitable.

4. D   When the efficient quantity is produced, the sum of consumer surplus and producer surplus is maximized.

5. B   The sum of the differences between price and opportunity cost is producer surplus.

6. B   In an unrestricted economy, the efficient quantity is the one for which the marginal benefit equals the marginal cost. When marginal benefit is greater than marginal cost at a given quantity, producers will produce more since consumers are willing to pay more than the cost of production.

7. A   Price deregulation removes an obstacle to the efficient allocation of resources.

8. B   Refer to Figure 4. You can see that the area of the triangle that represents consumer surplus increases as the steepness of the demand (marginal benefit) curve increases at a given equilibrium price and quantity.

MARKETS IN ACTION

EXAM FOCUS

This review examines how market equilibrium is affected by price ceilings, minimum wages, taxes, subsidies, quotas, and trade in illegal goods. For each of these you should know how supply, demand, and the resulting market equilibrium price and quantity are affected. Understand why economists believe that, in general, interference with market forces causes economic inefficiency (an inefficient allocation of resources).

LOS 15.a: Discuss the impact of price ceilings on equilibrium in the short and in the long run, and supply and demand, and the impact of a price ceiling on the existence of a black market.

A price ceiling is an upper limit on the price which a seller can charge. If the ceiling is above the equilibrium price, it will have no effect. As illustrated in Figure 1, if the ceiling is below the equilibrium price, the result will be a shortage (excess demand) at the ceiling price. The quantity demanded, Q_d, exceeds the quantity supplied, Q_s. Consumers are willing to pay P_{ws} (price with search costs) for the Q_s quantity suppliers are willing to sell at the ceiling price, P_c. Consumers are willing to expend effort with a value of $P_{ws} - P_c$ in search activity to find the scarce good. The reduction in quantity exchanged due to the price ceiling leads to a deadweight loss in efficiency as noted in Figure 1.

Figure 1: Price Ceiling
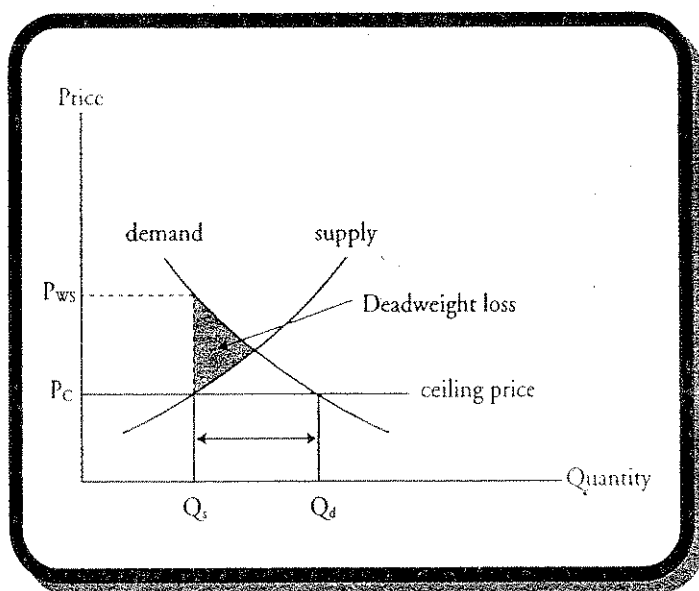
With an effective price ceiling, price is no longer an effective means of rationing the good or service. In the long run, price ceilings lead to the following:

*   Consumers may have to wait in long lines to make purchases. They pay a price (an opportunity cost) in terms of the time they spend in line.

- Suppliers may engage in discrimination, such as selling to friends and relatives first.
- Suppliers "officially" sell at the ceiling price, but take bribes to do so.
- Suppliers may also reduce the quality of the goods produced to a level commensurate with the ceiling price.

In the housing market, price ceilings are appropriately called rent ceilings or rent control. Rent ceilings are a good example of how a price ceiling can distort a market. Renters must wait for units to become available. Renters may have to bribe landlords to rent at the ceiling price. The quality of the apartments will fall. Other inefficiencies can develop. For instance, a renter might be reluctant to take a new job across town because it means giving up a rent-controlled apartment and risking not finding another (rent-controlled) apartment near the new place of work.

A black market refers to economic activity that takes place illegally. This includes selling goods at prices that exceed legally imposed price ceilings. Bribing a landlord to get a rent-controlled apartment is an example of black market activity. Another way for a landlord to charge rent that exceeds the rent ceiling is to "officially" rent at the ceiling, then charge excessive fees for items such as mailboxes, keys and locks, or window treatments.

A black market is generally inefficient because:

- Contracts are not as enforceable.
- The risk of prosecution increases the prices required by suppliers.
- Quality control deteriorates, which leads to more defective products.

LOS 15.b: Explain the effects of a minimum wage and the effects when it is set either above or below the equilibrium wage level.

A price floor is a minimum price that a buyer can offer for a good, service, or resource. If the price floor is below the equilibrium price, it will have no effect on equilibrium price and quantity. Figure 2 illustrates a price floor that is set above the equilibrium price. The result will be a surplus (excess supply) at the floor price, since the quantity supplied, Q_s, exceeds the quantity demanded, Q_d, at the floor price. There is a loss of efficiency (DWL) because the quantity actually transacted with the price floor, Q_d, is less than the unrestricted equilibrium quantity, Q_e.

Figure 2: Impact of a Price Floor
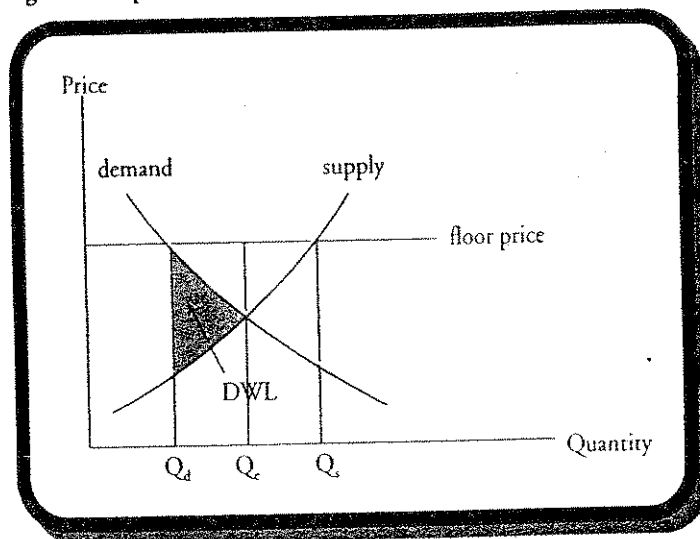
In the long run, price floors lead to inefficiencies:

- Suppliers will divert resources to the production of the good with the anticipation of selling the good at the floor price, but then will not be able to sell all they produce.
- Consumers will buy less of a product if the floor is above the equilibrium price and substitute other, less expensive consumption goods for the good subject to the price floor.

The **minimum wage** in the United States is an example of a price floor. At a minimum wage above the equilibrium wage, there will be an excess supply of workers, since firms cannot employ all the workers who want to work at that wage. Since firms must pay at least the minimum wage for the workers, firms substitute other productive resources for labor and use more than the economically efficient amount of capital. The result is increased unemployment because even when there is a large number of unemployed low-skilled workers willing to work at a wage lower than the minimum, firms cannot legally hire them. Furthermore, firms may decrease the quality or quantity of the nonmonetary benefits they previously offered to workers, such as pleasant, safe working conditions and on-the-job training.

LOS 15.c: Discuss the impact of tax, subsidies, quotas, and markets for illegal goods on demand, supply and the market equilibrium.

The Incidence of a Tax

A tax on a good or service will increase its equilibrium price and decrease its equilibrium quantity. Figure 3 illustrates the effects of a *tax on producers* and of a *tax on buyers* (e.g., a sales tax). In panel (a) the points indicated by P_E and Q_E describe the equilibrium prior to the tax. As a result of this tax, the supply curve shifts from S to S_{tax}, where the quantity Q_{tax} is demanded at the price P_{tax}.

The tax is the difference between what buyers pay and what sellers ultimately earn per unit. This is illustrated by the vertical distance between supply curve "S" and supply curve "S_{tax}." At the new quantity, Q_{tax}, buyers pay P_{tax}, but net of the tax, suppliers only receive P_S. The triangular area is a deadweight loss (DWL). This is the loss of gains from production and trade that results from the tax (i.e., because less than the efficient amount is produced and consumed).

Figure 3: Incidence of a Tax on Producers and a Tax on Buyers
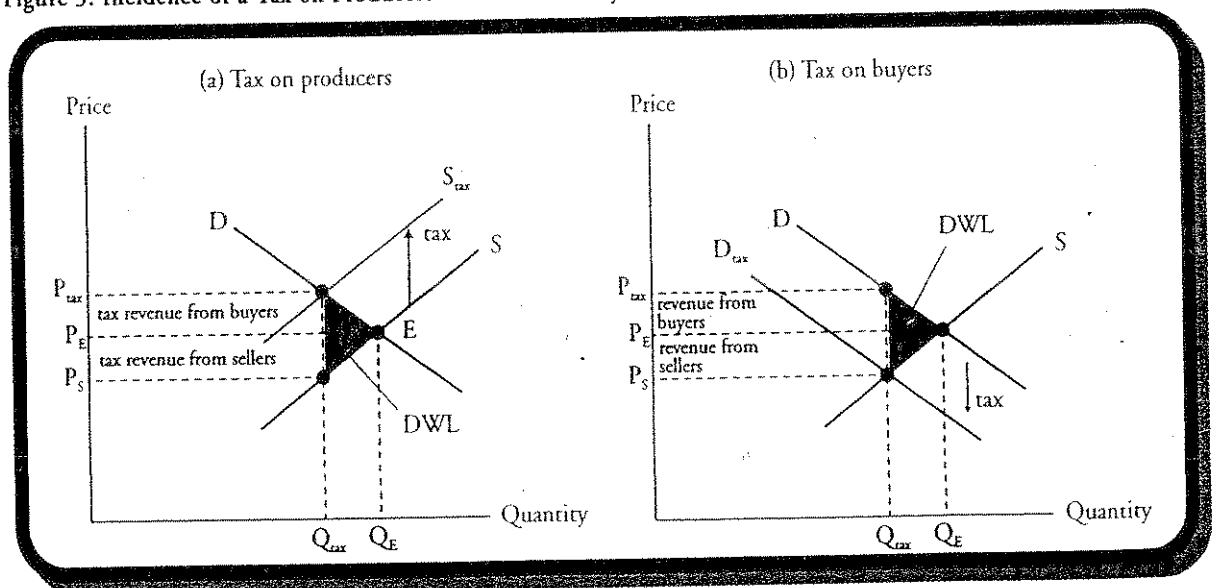
Note that in panel (b), although the statutory incidence of the tax is on buyers, the actual incidence of the tax, the reduction in output, and the consequent deadweight loss are all the same as in panel (a), where the tax is imposed on sellers.

The tax revenue is the amount of the tax times the new equilibrium quantity, Q_{tax}. Economic agents (buyers and sellers) in the market share the burden of the tax revenue. The incidence of a tax is allocation of this tax between buyers and sellers. The rectangle denoted "revenue from buyers" represents the portion of the *tax revenue* that the buyers effectively pay. "Revenue from sellers" illustrates the portion of the tax that the suppliers effectively pay.

Actual and Statutory Incidence of a Tax

Statutory incidence refers to who is legally responsible for paying the tax. The actual incidence of a tax refers to who actually bears the cost of the tax through an increase in the price paid (buyers) or decrease in the price received (sellers). In Figure 3(a), we illustrated the effect of a tax on the *sellers* of the good as opposed to the *buyers* of the good (note that the price is higher over all levels of production—the supply curve shifts up). Thus, the *statutory incidence* in Figure 3(a) is on the supplier. The result is an increase in price at each possible quantity supplied.

Statutory incidence on the *buyer* causes a downward shift of the demand curve by the amount of the tax. As indicated in Figure 3(b), prior to the imposition of a tax on buyers, the equilibrium price and quantity are at the point of intersection of the supply and demand curves (i.e., P_E, Q_E). The imposition of the tax forces suppliers to reduce output to the point Q_{tax} (a movement along the supply curve). At the new equilibrium, price and quantity are denoted by P_{tax} and Q_{tax}, respectively.

The tax that we are analyzing in Figure 3(b) could be a sales tax that is added to the price of the good at the time of sale. So, instead of paying P_E, buyers are now forced to pay P_{tax}, (i.e., tax = $P_{tax} - P_E$). The *buyer* pays the entire tax (the statutory incidence). Since, prior to the imposition of the tax, their reference point was P_E, the *buyer* only sees the price rise from P_E to P_{tax} (the buyer's tax burden). Hence, the portion of the tax borne by buyers is the area bounded by P_E, P_{tax}, and Q_{tax}; this is the actual tax incidence on buyers.

Note that the supply curve in Figure 3(b) does not move as a result of a tax on buyers, and that given the original demand curve, D, suppliers would have supplied the equilibrium quantity Q_E at price P_E. The result is that suppliers are penalized because they would have produced at the Q_E, P_E point, but instead produce at Q_{tax} and receive P_s. Hence, the portion of the tax borne by sellers is the area bounded by P_E, P_s, and Q_{tax}; this is the actual tax incidence on sellers. Note that we are still faced with the triangular deadweight loss.

Professor's Note: The point you need to know is that the actual tax incidence is independent of whether the government imposes the tax (statutory incidence) on consumers or suppliers.

How Elasticities of Supply and Demand Influence the Incidence of a Tax

When buyers and sellers share the tax burden, the relative elasticities of supply and demand will determine the actual incidence of a tax.

- If *demand is less elastic* (i.e., the demand curve is steeper) than supply, *consumers will bear a higher burden*, that is, pay a greater portion of the tax revenue than suppliers.
- If *supply is less elastic* (i.e., the supply curve is steeper) than demand, *suppliers will bear a higher burden*, that is, pay a greater portion of the tax revenue than consumers. Here, the change in the quantity supplied for a given change in price will be small—buyers have more "leverage" in this type of market. The party with the more elastic curve will be able to react more to the changes imposed by the tax. Hence, they can avoid more of the burden.

Panels (a) and (b) in Figure 4 are the same in all respects, except that the supply curve in panel (b) is significantly steeper—it is less elastic. Comparing panel (a) with panel (b), we can see that the portion of tax revenue borne by the seller is much greater than that borne by the buyer as the supply curve becomes less elastic. When demand is more elastic relative to supply, buyers "pay" a lower portion of the tax because they have the greater ability to substitute away from the good to a substitute.

Notice that as the elasticity of either demand or supply decreases, the deadweight loss is also reduced. This is because fewer trading opportunities are eliminated by the imposition of the tax, meaning that it is more difficult for either demanders or suppliers to substitute away from the good. With less effect on equilibrium quantity, the allocation of resources is less affected and efficiency is reduced less.

Figure 4: Elasticity of Supply and Tax Incidence
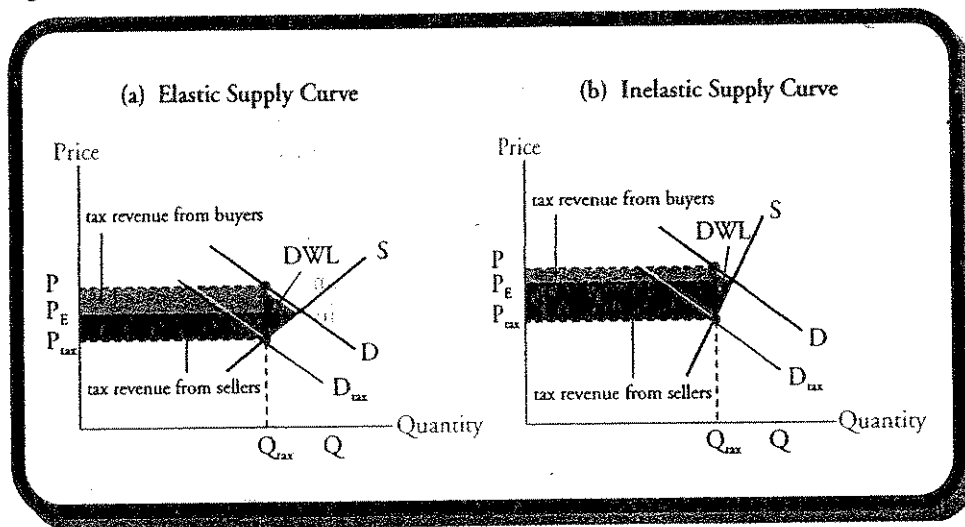
In Figure 5, we illustrate the result for differences in the elasticity of demand. In panel (b) demand is relatively more inelastic, and we see that the size of the deadweight loss (and the decrease in equilibrium output) is smaller when demand is more inelastic. We can also see that the actual incidence of the tax imposed on suppliers falls more heavily on buyers when demand is more inelastic.

Figure 5: Elasticity of Demand and Tax Incidence
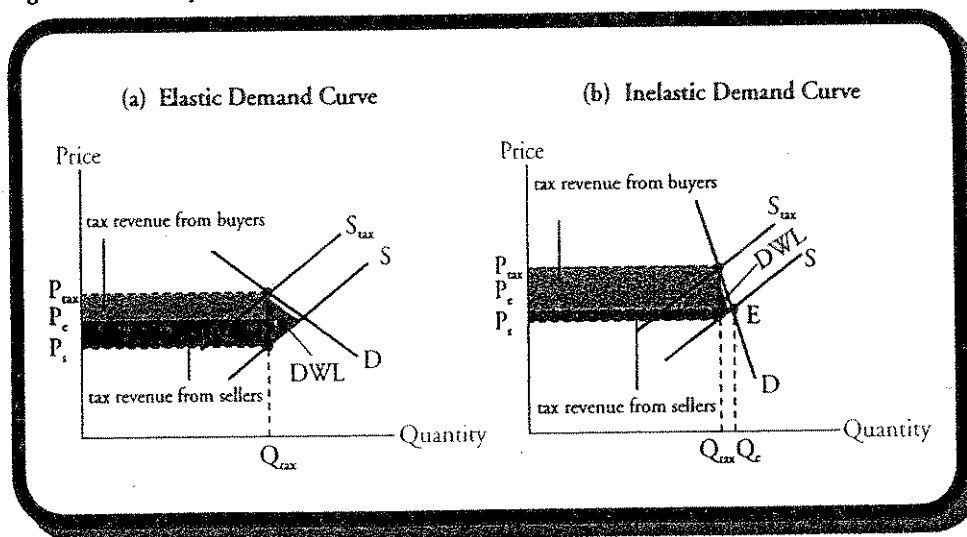
Subsidies and Quotas

Subsidies are payments made by governments to producers, often farmers. The effects of a subsidy are illustrated in Figure 6, where we use the market for soybeans as an example. Note here that with no subsidies, equilibrium quantity in the market for soybeans is 60 tons annually at a price of $60 per ton. A subsidy of $30 per ton causes a downward shift in the supply curve from S to (S – subsidy), which results in an increase in the equilibrium quantity to 90 million tons per year and a decrease in the equilibrium price (paid by buyers) to $45 per ton. At the new equilibrium, farmers receive $75 per ton (the market price of $45, plus the $30 subsidy).

Recognizing that the (unsubsidized) supply curve represents the marginal cost and that the demand curve represents the marginal benefit, the marginal cost is greater than the marginal benefit at the new equilibrium with the subsidy. This leads to a deadweight loss 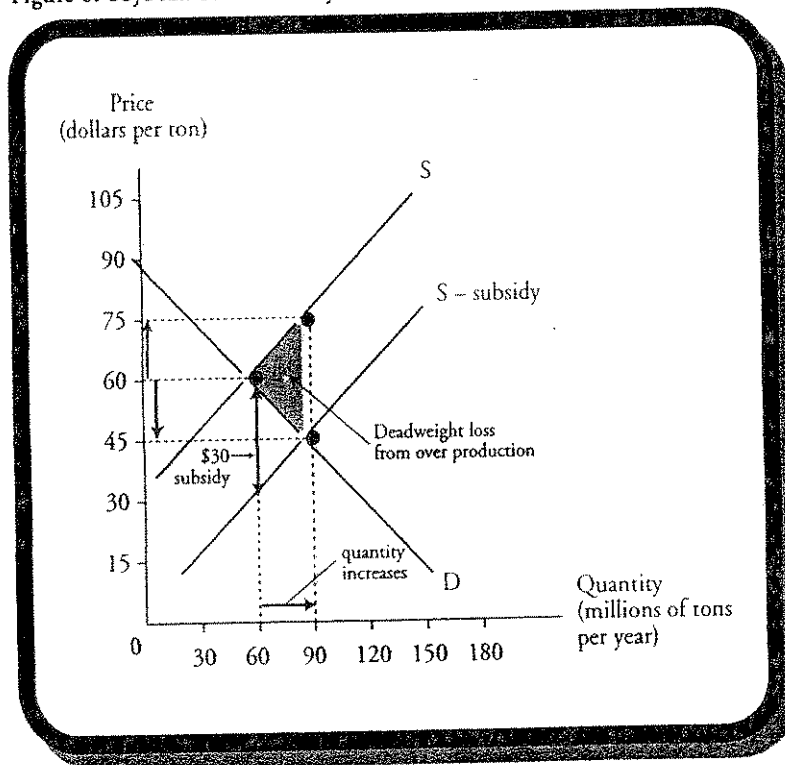from overproduction. The resources used to produce the additional 30 million tons of soybeans have a value in some other use that is greater than the value of these additional soybeans to consumers.

Figure 6: Soybean Price Subsidy

Production quotas are used to regulate markets by imposing an upper limit on the quantity of a good that may be produced over a specified time period. Quotas are often used by governments to regulate agricultural markets.

Continuing with our soybean example, let's suppose the government imposes a production quota on soybeans of 60 million tons per year. In Figure 7, we see that in the absence of a quota, soybean production is 90 million tons per year at a price of $45 per ton. With a 60 million ton quota, the equilibrium price rises to $75 per ton.

The reduction in the quantity of soybeans produced due to the quota leads to an inefficient allocation of resources. The quota not only increases the market price, it lowers the marginal cost of producing the quota quantity. At the quota amount, marginal benefit (price) exceeds marginal cost. This explains why producers often seek the imposition of quotas.

Note that if a quota is greater than the equilibrium quantity of 90 million tons, nothing will change because farmers are already producing less than the maximum production allowed under the quota.

Figure 7: Soybean Production Quota
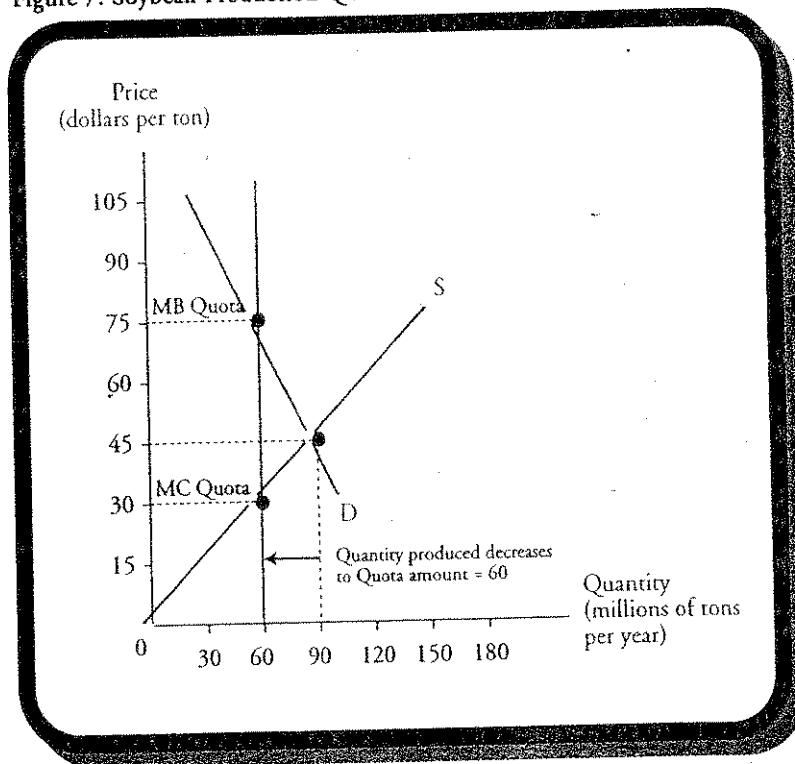
Illegal Goods

When people get caught buying or selling illegal goods, such as drugs or guns, they must pay penalties, including fines, imprisonment, or both. As the severity of the penalty or the likelihood of getting caught increases, the total costs of illegal trade increase. To see how the penalties from breaking the law affect the equilibrium quantity of an illegal good, consider the U.S. market for Cuban cigars illustrated in Figure 8. Here, the supply curve, S, represents the minimum prices that sellers would accept if Cuban cigars were legal, and the demand curve, D, represents the maximum prices that buyers would pay for Cuban cigars without any laws restricting their purchase. The equilibrium price and quantity under legal trade are at point L, where the equilibrium quantity is Q_L at a price of P_L. Because selling Cuban cigars is illegal in the U.S., the compensation for the *expected penalty* for selling cigars, EP_S, is added to the sellers' minimum prices, shifting the supply curve in Figure 8 up to $S + EP_S$. If only sellers are penalized, the new equilibrium is represented by point M.

In the U.S. it is also illegal to purchase and possess Cuban cigars, so the cost of the expected penalties for buyers must be subtracted from the maximum price that buyers are willing to pay. This causes the demand curve to shift downward to $D - EP_D$. If only buyers were subject to the penalty, the Cuban cigar market would move from point L to N.

When both buyers and sellers of illegal Cuban cigars must pay a penalty, the new equilibrium price and quantity are represented by point O in Figure 8. As we have drawn it, the expected penalties for sellers and buyers are equal ($EP_S = EP_D$), so the new market price remains at the original market price, P_L, but the quantity purchased declines to Q^*. Effectively, buyers pay P_B, which is P_L plus an added cost equal to the value of the expected penalty for buying and possessing Cuban cigars, and sellers effectively receive P_S, which is P_L minus the amount

to compensate for the expected penalty for selling Cuban cigars. Note that buyers pay, and sellers receive, a cash price equal to P_L in this example.

The decrease in supply or demand for an illegal good increases as the value of the penalty increases. If the penalty is larger for the seller, the supply curve will shift by a greater amount than the demand curve and the cash market price will rise above what it would have been if the good were not illegal, perhaps very significantly so. The opposite is true when penalties are higher for buyers.

Figure 8: Market for Illegal Cigars
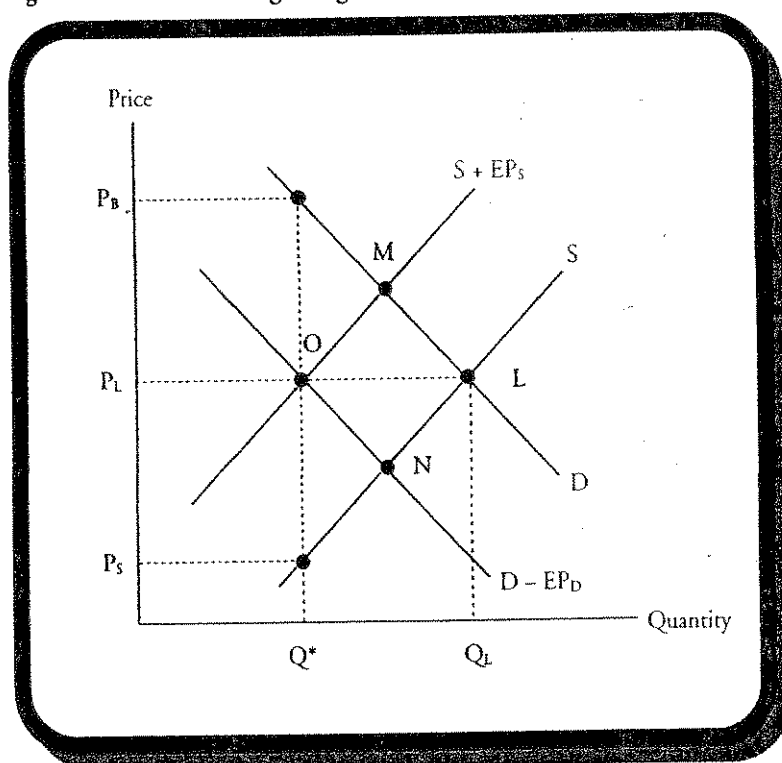
KEY CONCEPTS

1. Price ceilings set below the equilibrium price lead to shortages, waiting in line, bribes, a decrease in quality, and black markets.
2. A black market operates outside the legal system, selling goods that are illegal or under price controls.
3. A minimum wage above the equilibrium wage leads to unemployment and lengthy job searches.
4. The actual incidence of a tax refers to the extent to which buyers and sellers actually bear the cost of a tax. The statutory incidence of the tax refers to who must legally pay the tax. The actual incidence of a tax is independent of the statutory incidence of the tax and depends on the relative elasticities of supply and demand.
5. Subsidies increase equilibrium quantities and lead to deadweight losses from overproduction.
6. Production quotas decrease equilibrium quantities and lead to deadweight losses from underproduction.
7. The expected penalties for trading in illegal goods cause both demand and supply curves to shift to the left, decreasing the equilibrium quantities compared to equilibrium quantities if the goods were legal.

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CONCEPT CHECKERS: MARKETS IN ACTION

1. A market that operates outside the legal system, having prices that exceed legally imposed price ceilings, is a/an:
    A. black market.
    B. incident market.
    C. subsidized market.
    D. quota controlled market.

2. Rent control is an example of a:
    A. quota.
    B. subsidy.
    C. price floor.
    D. price ceiling.

3. A minimum wage is an example of a:
    A. quota.
    B. subsidy.
    C. price floor.
    D. price ceiling.

4. Quotas placed above the equilibrium quantity:
    A. increase marginal cost.
    B. result in overproduction.
    C. have no effect on output.
    D. result in underproduction.

5. A subsidy:
    A. shifts the supply curve down.
    B. has no effect on output.
    C. increases marginal benefit.
    D. leads to underproduction.

6. As a result of a production quota set below the equilibrium quantity:
    A. marginal benefit will exceed marginal cost.
    B. marginal cost will exceed marginal benefit.
    C. marginal benefit and marginal cost will decline.
    D. marginal benefit will be forced into equality with marginal cost.

7. Assume a good becomes illegal to buy or sell, and the expected penalty for selling the good is greater than that for buying the good. Relative to when the good was legal:
    A. price and quantity will rise.
    B. price and quantity will decline.
    C. price will rise and quantity will decline.
    D. price will remain the same, but quantity will fall.

8. A price ceiling is only effective if it:
    A. is set above the equilibrium price.
    B. is set below the equilibrium price.
    C. has been in effect over a long time.
    D. has been in effect in over a relatively short time.

9. An example of a price floor is:
    A. rent controls.
    B. a tax on ceramic tile.
    C. a subsidy for wheat production.
    D. a minimum price for milk.

10. The government imposes a tax on a good. The relative amounts that each economic unit in the market pays of the tax is called the:
    A. statutory tax.
    B. tax incidence.
    C. tax imposition.
    D. deadweight loss.

ANSWERS – CONCEPT CHECKERS: MARKETS IN ACTION

1. A A black market is a market where trades of goods prohibited by law or trades at prices prohibited by law are made.

2. D Rent controls are price ceilings and have the effect of reducing supply.

3. C A minimum wage is a price floor and will likely increase unemployment.

4. C A quota that is less than the equilibrium output quantity leads to a decrease in production and a deadweight loss from an inefficient allocation of resources. Quotas above the equilibrium quantity have no effect on output quantity.

5. A A subsidy effectively shifts the supply curve down. The resulting new equilibrium will be at a quantity where marginal cost is greater than marginal benefit so that there is an economic loss from production of more than the optimal amount of the subsidized good.

6. A If output is forced to be below the equilibrium quantity, the marginal benefit will exceed the marginal cost and a deadweight loss comes about from underproduction.

7. C If the expected penalty to sellers of illegal goods is greater than that to the buyers, the supply curve will shift up more than the demand curve will shift downward. The result is that price will rise and quantity will decline.

8. B A price ceiling is only effective if it is lower than the equilibrium price without the ceiling. This leads to a shortage as consumers wish to purchase a quantity of the good at the ceiling price which is greater than the quantity supplied at that price.

9. D A price floor is a minimum on the price that suppliers can charge. Such floors were once common in agricultural markets.

10. B This is the definition of the incidence of a tax. It is determined by the shape of the supply and demand curves, not upon whom the tax is imposed legally (the statutory incidence of the tax).

ORGANIZING PRODUCTION

EXAM FOCUS

Make sure you can calculate economic profit, which requires that you identify relevant opportunity costs. Also, you should understand the different types of market competition and the issues surrounding the concentration measures of the degree of competition.

The pros and cons of the different forms of business organization are another likely exam topic. You should also be able to differentiate between technological and economic efficiency. A basic understanding of what the principal-agent problem will be sufficient here.

LOS 16.a: Explain the different types of opportunity cost and the relationship to economic profit, and calculate economic profit.

Opportunity cost is the return that a firm's resources could have earned elsewhere in its next most valuable use. Opportunity cost includes both explicit and implicit costs.

Explicit costs are observable, measurable expenses such as the dollar cost of production inputs and the interest cost of renting (borrowing) capital.

Implicit costs are not explicitly observable and fall into two categories: (1) the opportunity cost to a firm of using its own capital and (2) the opportunity cost of the time and financial resources of the firm's owners.

- The *implied rental rate* is the term used to describe the opportunity cost to a firm for using its own capital. It represents what the firm could have earned if it had rented its capital (money and/or physical assets) to another firm. The implied rental rate is the sum of: (1) *economic depreciation*, which is the decrease in the value of a firm's assets over time, and (2) *foregone interest*.
- *Normal profit* is the opportunity cost of owners' entrepreneurial expertise. It represents what owners could have earned if they used their organizational, decision-making, and other entrepreneurial skills in another activity, such as running another business.

Economic profit considers both explicit and implicit costs. When the firm's revenues are just equal to its opportunity costs (explicit and implicit costs, including a normal profit), economic profits are zero. The computation of economic profit is illustrated in Figure 1.

Figure 1: Calculating Economic Profit for Patrick's Surfboard Company

Account		Amount
Total revenue		$340,000
Opportunity costs		
Fiberglass	$100,000	
Electricity	30,000	
Employee wages paid	55,000	
Interest paid on borrowed funds	5,000	
Total explicit costs		$190,000
Patrick's foregone wages	35,000	
Patrick's foregone interest	10,000	
Economic depreciation on buildings	5,000	
Normal profit	60,000	
Total implicit costs		$110,000
Total cost		$300,000
Economic profit		$40,000

Professor's Note: Accounting profit only recognizes explicit costs, so it is greater than economic profit.

LOS 16.b: Discuss the firm's constraints and their impact on maximum profit.

Constrained profit maximization. Firms face three primary constraints as they endeavor to maximize profits: (1) technological, (2) information, and (3) market constraints.

Technology constraints. For our current purposes, technology may be defined simply as the means of producing a good or service. Technological developments are continuous. At any given point in time, a firm has the opportunity to increase output, and ultimately revenue, by employing additional technological resources. But to do so often means that the firm must incur additional costs. The additional profit from any increased output and revenue is limited by the cost of adopting new technology.

Information constraints. Profit maximization is constrained by the lack of information on which to base decisions. Many times, more information is available, but the cost of obtaining it may exceed its value (to increase firm profits). As with any productive resource, the firm will expend resources to acquire additional information only up to the point where the increase in total revenue from additional information is greater than the cost of the information.

Market constraints. Profits are also constrained by how much consumers are willing to pay for a firm's product or service and by the prices and marketing activities of its competitors. Resource markets also place constraints on profit maximization. The prices and availability of the resources that a firm uses and the willingness of people to invest in the firm present constraints on the firm's growth.

LOS 16.c: Distinguish between technological and economic efficiency, and discuss under which circumstances a firm is technological or economically efficient.

Technological efficiency refers to using the least amount of specific inputs to produce a given output.

Economic efficiency refers to producing a given output at the lowest possible cost.

The difference between technological and economic efficiency is illustrated in the following example. Consider the four methods of producing a microwave oven illustrated in Figure 2.

Figure 2: Methods for Manufacturing 100 Microwave Ovens Per Day

Method*	Input Quantities	
	Capital (machine-day equivalent)	Labor (worker-days)
Robotic manufacturing (RM)	5,000	5
Assembly line manufacturing (ALM)	50	50
Work station manufacturing (WSM)	50	500
Hand crafted manufacturing (HCM)	5	5,000

*Method descriptions:
- RM requires one worker to monitor a completely robotic process.
- ALM requires the microwave assembly to be automatically moved from one work station to the next, where the worker at that station performs a specific, repetitive operation.
- WSM requires the workers to move from station to station to perform the same operation.
- HCM requires one worker to build an entire microwave oven using specialized tools.

An examination of the microwave oven manufacturing methods described in Figure 2 reveals that robotic manufacturing (RM) uses the most capital and least labor, whereas hand crafted manufacturing (HCM) uses the most labor and least capital. Assembly line manufacturing (ALM) and work station manufacturing (WSM) fall between these two extremes. WSM uses 50 units of capital and 500 units of labor to produce 100 ovens per day; ALM can also produce 100 ovens using 50 units of capital, but requires only 50 units of labor. ALM is more *technologically efficient* than the WSM method because it uses absolutely less inputs to produce the same output.

Both the RM and HCM methods are technologically efficient because compared to ALM, RM uses less labor (but more capital), and HCM uses less capital (but more labor).

Economic efficiency is achieved when a given level of output is achieved at the least possible cost. Let's assume for our example that labor costs $75 per worker-day and capital costs $250 per machine-day. The costs of the four different methods are shown in Figure 3. ALM has the lowest cost per oven. Even though RM requires the least amount of labor, it requires more capital. On the other hand, while the HCM method requires the least amount of capital, it uses much more labor.

Recall that WSM is not technologically efficient. This fact ensures that WSM is not economically efficient either. WSM uses the same capital input ($12,500) as ALM, but requires much more labor ($37,500 versus $3,750).

The total costs in Figure 3 will be different if the costs of labor and capital are different. Firms must routinely re-evaluate economic efficiency as the costs of inputs change.

Figure 3: The Cost of Four Methods of Manufacturing 100 Microwave Ovens Per Day

Method	Capital Cost $250/unit	Labor Cost $75/unit	Total Cost	Cost Per Oven
RM	$1,250,000	$375	1,250,375	$12,503.75
ALM	12,500	3,750	16,250	162.50
WSM	12,500	37,500	50,000	500.00
HCM	1,250	375,000	376,250	3,762.50

LOS 16.d: Discuss the different ways a firm can organize production, how the principal-agent problem occurs, and which measures a firm can take to reduce the impact of the principal-agent problem.

Firms can organize production in two different ways: (1) command systems and (2) incentive systems.

Command systems organize production according to a managerial chain of command. In a command system, managers spend much of their time processing information about the performance of the people who report to them, about what steps to take, and the best way to implement those steps. The U.S. military is an example of a command system; the President is at the top of the hierarchy. For a corporation using a command system of organizing production, the Chief Executive Officer is at the top of the system.

An incentive system is a means of organizing production whereby senior management creates a system of rewards intended to motivate workers to perform in such a way as to maximize profits. It is an effective system for organizing the production of a large sales force, where sales people may be paid a base salary that is relatively small, and also rewarded for sales volume. CEOs are often subject to incentive systems, which provide them with compensation based on their firm's profit, sales, or stock price performance.

Command systems and incentive systems are often mixed within the same organization. Command systems are used when it is easy to monitor the performance of employees, as in the case of production workers. Incentive systems are usually most effective for organizing the production of employees whose activities are difficult or costly to monitor, like those of the firm's CEO and senior officers or outside sales people.

The principal-agent problem refers to the problems that arise when the incentives and motivations of managers and workers (agents) are not the same as the incentives and motivations of their firm's owners (principals). In many corporations, agents have their own goals, which may be different than those of the principals. For workers, there is often an incentive to shirk, which is to work below their normal level of productivity. At the managerial level, managers may work to maximize their own income and benefits rather than to maximize the value of the firm to its owners. The essence of the problem is that it is difficult or costly for the principals to monitor the actions of the agents.

Three methods are commonly used to reduce the principal-agent problem by better aligning the motivations of agents with those of principals: (1) ownership, (2) incentive pay, and (3) long-term contracts.

* When managers or workers have an *ownership* interest in the firm, it may motivate them to perform in a manner that maximizes the firm's profits or value. Ownership arrangements are commonly used with senior management, but less so for workers.
* *Incentive pay* is pay that is based on performance and is quite common in many industries. Incentive pay may be based on profits, sales, production quotas, or stock prices. Promotions may also be used as a form of incentive pay to align the interests of a firm's agents and principals.
* *Long-term contracts* for employment are often assigned to firms' CEOs to encourage them to develop strategies that will maximize profits over a relatively long period.

LOS 16.e: Distinguish between the different types of business organization, discuss the advantages and disadvantages of each of the systems both individually and relative to each other.

Types of business organization. The three main forms of business organization are: (1) proprietorships, (2) partnerships, and (3) corporations. Each form has its own advantages and disadvantages.

A proprietorship is a form of business organization with a single owner who has unlimited liability for the firm's debts and other legal obligations. Income flows through to the proprietor (owner) who pays taxes on it as personal income.

- *Advantages*: Easy to establish, simple decision making process, and profits are only taxed once.
- *Disadvantages*: Decisions are not checked by a group consensus, the owner's entire wealth is exposed to risk, the business may cease to exist when the owner dies, and raising capital can be difficult and relatively expensive.

A partnership form of business organization involves two or more owners who both have unlimited liability for the debts and other legal obligations of the partnership. A partnership's taxable income is allocated (as personal income) to the partners based on their proportional ownership of the partnership.

- *Advantages*: Easy to establish, decision making is diversified among partners, may survive even if a partner leaves or dies, and profits are only taxed once.
- *Disadvantages*: It can be difficult to achieve consensus decisions, owners' entire wealth is exposed to risk, and there may be a capital shortfall when a partner dies or leaves for other reasons. Since each partner may bring capital to the firm, capital is generally more readily available than for a proprietorship, but there are still significant limitations on the ability to raise large amounts of capital.

A corporation is owned by its stockholders, and their liability is legally limited to the amount of money they have invested in the firm. The firm is a legal entity that pays (corporate) income taxes. Corporations account for the largest share of revenue by far among the three types of business organization.

- *Advantages*: Owners have limited liability, large amounts of relatively inexpensive capital are available, management expertise is not limited to that of the owners, a corporation's life is not limited to that of the owners, and long-term labor contracts can be used to reduce costs.
- *Disadvantages*: Relatively complex management structure may make the decision-making process slow and costly, and double taxation—corporate earnings are taxed when earned and again when distributed to owners as dividends.

Professor's Note: The most commonly cited advantages of the corporate form of business over proprietorships and partnerships is its unlimited access to relatively cheap capital and its limited liability to the owners. The biggest disadvantage of the corporate form over the other two forms is the double taxation of distributed profits.

LOS 16.f: Identify the different market types, and describe the conditions that characterize them.

The four types of economic markets are: (1) perfect competition, (2) monopolistic competition, (3) oligopoly, and (4) monopoly.

Perfect competition exists when all the firms in the market produce identical products. There is a large number of independent firms, each seller is small relative to the total market, and there are no barriers to entry or exit. Furthermore, each of the many buyers and sellers knows the prices of the competing products in the market.

Monopolistic competition is the term used to describe markets where a large number of competitors produce (slightly) differentiated products. *Product differentiation* gives a degree of market power to firms under monopolistic competition because each firm produces a slightly different product. Laundry detergent and canned spaghetti sauce are examples of products that are sold under monopolistic competition.

Oligopoly is a market structure characterized by a small number of producers selling products that may be similar or differentiated. There is interdependence among competitors in that the decisions made by one firm affect the demand, price, and profit of others in the industry. Also, significant barriers to entry exist which often include large economies of scale. The U.S. auto and soft drink industries are examples of oligopoly markets.

Monopoly markets are characterized by a single seller of a specific, well-defined product that has no good substitutes. Barriers to entry are high in monopoly markets. Whether a monopoly exits often depends on how we define the product. Microsoft Corp. certainly has a monopoly of sorts on the Windows® operating system and related software. If we define the market more broadly, there are other operating systems, word processing programs, spreadsheet programs, and so forth.

LOS 16.g: Explain the different ways in which concentration can be measured, and discuss the limitations of concentration measures.

The concentration of a market refers to the distribution of firms' market shares. Markets with a few large firms are more concentrated than markets with many smaller firms. There are two primary measures of market concentration, the four-firm concentration ratio and the Herfindahl-Hirschman Index.

Professor's Note: You will see the concentration ratio and the Herfindahl index again in Study Session 14.

The **four-firm concentration ratio** is the percentage of total industry sales made by the four largest firms in an industry. A highly competitive industry may have a four-firm concentration ratio near zero, while the ratio is 100% for a monopoly. A four-firm concentration ratio below 40% is considered an indication of a competitive market, and a four-firm ratio greater than 60% indicates an oligopoly.

The **Herfindahl-Hirschman Index (HHI)** is calculated by summing the squared percentage market shares of the 50 largest firms in an industry (or all of the firms in the industry if there are less than 50). The HHI is very low in a highly competitive industry and increases to 10,000 ($= 100^2$) for an industry with only one firm. An HHI between 1,000 and 1,800 is considered moderately competitive, while an HHI greater than 1,800 indicates a market that is not competitive.

The usefulness of concentration measures as indicators of the degree of competition in a market is limited because they do not properly account for: (1) the geographical scope of the market, (2) barriers to entry and firm turnover in a market, and (3) the relationship between a market and an industry.

The *geographical scope of the market* refers to the fact that products may be marketed in regional, local, or global markets. For example, concentration measures for newspapers in the global market are low, indicating a highly competitive market. But the concentration of newspapers in any given city is usually quite high, indicating relatively low competition at the local market level.

Barriers to entry and firm turnover in a market are not captured in concentration measures. While a small town may have few appliance stores, indicating a lack of competition, there is no barrier to opening a new appliance store, which increases the competitiveness of the market.

The *relationship between a market and an industry* is not always close, even though concentration measures assume that each firm fits neatly within one specific industry. There are three reasons why firms do not always fit neatly in a given industry. First, markets are often narrower than an industry. Companies may be in the same industry but sell specific products that do not compete with each other. Second, most large firms produce many different products, each facing different levels of competition. Concentration ratios, however, assume one market for the firm as a whole. Finally, firms may switch from one market to another in order to maximize profit. The ability to easily enter and exit a market increases the competition in that market.

LOS 16.h: Discuss the two ways in which economic activity can be coordinated, and the different ways in which firms are often more efficient than markets.

Economic activity can be produced through market coordination or through firm coordination.

Market coordination is best described through an example. Consider the production of a heavyweight boxing match. The fight promoter hires an arena, a boxing ring, broadcast specialists, concession services, some boxers, a publicity agency, and a ticket agent. These are all market transactions. The promoter then sells tickets to the event through the ticket agent, along with broadcasting rights to a television network. So, the fight is produced through the coordination of markets.

Another example of market coordination is outsourcing. With outsourcing, a manufacturer of a product buys some or all of the product's components from other firms. The manufacturer then assembles all of the outsourced components to produce the final product. Outsourcing is a common practice in the automobile and personal computer industries.

Firm coordination occurs when firms can coordinate economic activity more efficiently than markets can. This is possible because firms can often achieve lower transaction costs, economies of scale, economies of scope, and economies of team production.

- *Transaction costs* refer to the costs associated with the negotiations that must take place when attempting to coordinate markets. Firms can often reduce transaction costs by reducing the number of individual transactions that must take place.
- *Economies of scale* exist when the average unit cost of producing a good decreases as output increases.
- *Economies of scope* occur when a firm can use its specialized resources to produce a range of goods and services. For example, a publisher hires editors, typists, reporters, marketing experts, and media distribution specialists and uses their skills across all of the firm's published products. This is less expensive to the publisher than it would be for an individual who attempted to hire these services individually in the markets.
- *Economies of team production* occur when a team of a firm's employees becomes highly efficient at a given task. It is usually less expensive for a firm with a well-honed team to produce a good or service than for an individual who has to hire the individual members of a team in the markets.

KEY CONCEPTS

1. Opportunity cost for a firm is the value of the resources it owns in their next highest valued productive use.

2. Explicit costs are measurable expenses. Implicit costs include the opportunity cost to a firm from the use of its own capital, and the opportunity cost associated with the use of the owners' resources.

3. Implied rental rate is the opportunity cost to a firm for using its own capital and includes economic depreciation and foregone interest. Normal profit is the opportunity cost of owners' time, resources, and entrepreneurial expertise.

4. Economic profit is total revenue minus both explicit and implicit costs, including normal profits.

5. The three primary constraints on profit maximization are the level of technology, the amount of information, and the characteristics of the markets for the firm's output and for the resources it employs.

6. Technological efficiency is achieved when the least amount of inputs is used to produce a given output. Economic efficiency is achieved when a given output is produced at the lowest possible cost.

7. Command systems organize production according to a chain of command. Incentive systems organize production through a system of rewards.

8. The principal-agent problem exists because agents (managers and workers) do not have the same motivations and incentives as the firm's principals (owners). Ownership interests, incentive pay, and long-term employment contracts are used to reduce the effects of the principal-agent problem.

9. A proprietorship, a business with one owner, is easy to start, has a simple decision process, and its profits are only taxed once; however, there are no decision reviews, the owner's entire wealth is at risk, the business may cease to exist if its proprietor dies, and its ability to raise capital is quite limited.

10. A partnership, a business with two or more owners, is easy to start, its decisions are reviewed by partners, it can survive if a partner leaves or dies, and its profits are only taxed once; however, it may be difficult to reach consensus decisions, each partner's entire wealth is at risk, there may be a capital shortfall if a partner leaves, and access to capital is limited compared to a corporate structure.

11. A corporation is a legal entity owned by its stockholders who each have limited liability. A corporation can raise large amounts of capital, has managerial expertise that is not limited to that of the owners, and has an unlimited life; however, corporations are burdened by complex management structures and double taxation of profits that are distributed to shareholders.

12. Perfect competition exists when many firms exist, all the firms sell the same identical product, each firm is small relative to the total market, and there are no barriers to entry or exit.

13. Monopolistic competition refers to a market in which a large number of competitors produce slightly differentiated products.

14. Oligopoly refers to a market in which a small number of firms sell products that may or may not be differentiated and decisions made by one firm affect the demand, price, and profit of its competitors.

15. Monopoly markets have one seller of a specific, well-defined product that has no good substitutes and high barriers to entry.

16. Market concentration measures indicate the degree of competition. The four-firm concentration ratio is the sum of the percentage market shares of the four largest firms in an industry. The Herfindahl-Hirschman Index is the sum of the squared percentage market shares of the 50 largest firms in an industry. The usefulness of concentration measures is limited because they do not reflect the geographical scope of the market, barriers to entry and firm turnover, or the relationship between markets and industries.

17. Outsourcing is an example of market coordination, production by coordinating the activities of several other producers.

18. Firm coordination occurs when firms can coordinate economic activity more efficiently than markets by reducing transaction costs and by achieving economies of scale, scope, and team production.

CONCEPT CHECKERS: ORGANIZING PRODUCTION

1.   Economic profits are zero if:
     A.   implicit costs equal explicit costs.
     B.   economic depreciation equals zero.
     C.   total revenue equals the sum of all opportunity costs.
     D.   the implied rental rate equals forgone interest.

2.   Assume that a firm had total revenue of $50 million and used $30 million in labor and materials to generate that revenue. Other costs included $100,000 in foregone interest, economic depreciation of $20,000, and normal profit is $65,000. Using this information, calculate the economic profit to the firm.
     A. $19,803,000.
     B. $19,815,000.
     C. $19,856,000.
     D. $20,000,000.

3.   Which of the following statements regarding technological and economic efficiency is *most accurate?*
     A.   Whenever an activity is technologically efficient, it must be economically efficient.
     B.   It is not possible for an economic activity to be both economically and technologically efficient.
     C.   For a given output, a technologically efficient method uses the least amount of inputs and an economically efficient method has lowest possible cost.
     D.   For a given output, a technologically efficient method uses the least amount of labor and an economically efficient method uses the least amount of capital.

4.   Consider two markets: one has a Herfindahl-Hirschman Index (HHI) of 500, while the other has a four-firm ratio concentration ratio equal to 2%. Which of the following statements *most accurately* describes these two markets?
     A.   Both markets are highly competitive.
     B.   Both of these markets are monopolies.
     C.   The market with the HHI equal to 500 is very competitive, while the other market has a low degree of competition.
     D.   The market with the HHI equal to 500 has a low degree of competition, while the other market is highly competitive.

5.   The implied rental rate includes:
     A.   normal profit and explicit costs.
     B.   foregone interest and normal profit.
     C.   economic depreciation and normal profit.
     D.   economic depreciation and foregone interest.

6.   An industry with a Herfindahl-Hirschman Index (HHI) of 2,800 and a four-firm concentration ratio of 75% is *most likely* competing in which type of market?
     A.   Oligopoly.
     B.   Monopoly.
     C.   Perfect competition.
     D.   Monopolistic competition.

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7. Which of the following is *least likely* to be used to reduce the principal-agent problem in corporations?
A. Use of a company jet.
B. An ownership incentive.
C. An incentive-pay system.
D. Long-term employment contracts.

8. Which of the following statements *least accurately* describes why firms can sometimes coordinate economic activity more efficiently than markets? Firms can achieve economies of:
A. scale.
B. scope.
C. cost.
D. team production.

9. Consider two manufacturing processes that can be used to produce the same quantity of a given product. Process A uses 10 units of labor and 50 units of physical capital. Process B uses 10 units of labor and 500 units of capital. Which of the following *most accurately* describes these two processes?
A. Process A is economically efficient and technologically efficient.
B. Process B is technologically inefficient and economically efficient.
C. Process A is technologically efficient and either may be economically efficient.
D. Process B is technologically inefficient and either may be economically efficient.

ANSWERS – CONCEPT CHECKERS: ORGANIZING PRODUCTION

1. C   Economic profit considers both explicit and implicit opportunity costs. When total revenues are just equal to opportunity costs (explicit and implicit, including normal profit), economic profits are zero.

2. B   Economic profit = total revenue – opportunity costs = total revenue – (explicit + implicit costs). In this case, the labor and material cost of $30 million is the explicit cost. Implicit costs include the $100,000 in foregone interest, economic depreciation of $20,000, and normal profit of $65,000. So, total implicit costs equal $100,000 + $20,000 + $65,000 = $185,000. Thus, economic profit is $50,000,000 – $30,000,000 – $185,000 = $19,815,000.

3. C   Technological efficiency is achieved by using the least amount of inputs to produce a given output. Economic efficiency is achieved by producing a given output at the lowest possible cost.

4. A   An HHI of 500 is low, indicating a high degree of competition. A four-firm concentration ratio of 2% indicates a high level of competition. The higher (lower) the concentration measure, the lower (greater) the degree of competition.

5. D   The implied rental rate includes economic depreciation and foregone interest. When discussing economic profit, economic depreciation is the decrease in the value of an asset while that asset is being used to produce a product.

6. A   A monopoly market has a Herfindahl-Hirschman Index of 10,000 and a four-firm concentration ratio of 100%. An HHI index greater than 1,800 indicates an uncompetitive market and a four-firm ratio greater than 60% indicates an oligopoly market. Therefore, the firms in the industry described are most likely in an oligopoly market.

7. A   A company jet could be a symptom of a principal-agent problem and does not address a divergence of incentives. The other three are common methods to reduce the principal-agent problem.

8. C   Firms can often coordinate economic activity more efficiently than markets because firms can reduce the costs of market transactions, and they can achieve economies of scale, scope, and team production. Economies of cost is a made-up term.

9. A   Process A is technologically efficient because for the same 10 units of labor, it can produce the given output with less capital. For any prices of capital and labor, Process A must have a lower cost, so it is also the economically efficient process.

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OUTPUT AND COSTS

EXAM FOCUS

This review is primarily focused on the relationship between short-run costs and output. You should know how total, marginal, and average product relate to the components of total cost. Be able to describe diminishing returns to labor and capital, and understand the long-run conditions that lead to economies of scale.

LOS 17.a: Explain why technology is a constraint on the increase of output in the short-term, how a firm can change output in the short run using the concepts of total, marginal, and average product, and the implication on short-run cost using the concepts of total, marginal, and average cost.

The *short term* (short run) is defined as a time period for which quantities of some resources are fixed. A firm has chosen its production methods and, if it is a manufacturer, the machinery it will use to produce its products.

So the technology of production is fixed in the short run and is a constraint on a firm's ability to increase production. Typically, economists treat labor and raw materials as variable in the short run, holding plant size, capital equipment, and technology constant.

In what follows, we will examine output in the short run, allowing only the quantity of labor employed to vary.

The table in Figure 1 contains output information for a hypothetical maker of shirts, Sam's Shirts. The first column of the table lists different quantities of workers per day that can be employed. The second column lists the total number of shirts per day that Sam's can produce with different numbers of workers, holding plant and equipment constant. This total output of shirts is called the **total product**. The third column has the number of additional shirts per day from adding each successive worker. This is the **marginal product** of labor, the additional output from adding one more unit (in this case one worker-day) of labor. The fourth column lists the average number of shirts per worker that are produced for each quantity of workers. This is the **average product** of labor. Note that the units of total, marginal, and average product are units of the good produced per unit of the input under consideration, in this case, shirts per worker day.

Figure 1: Short-Run Output as a Function of Labor Employed

Workers	Total Product	Marginal Product	Average Product
1	8	8	8
2	20	12	10
3	26	6	8.7
4	30	4	7.5
5	32	2	6.4
6	33	1	5.5

Panel (a) and panel (b) of Figure 2 show the total product curve and marginal product curve, respectively, for Sam's Shirts. The total and marginal product curves in Figure 2 have been "smoothed" to account for fractional worker days.

Note that the marginal product curve shown in panel (b) of Figure 2 initially increases, reaches a peak, and then begins to decline. This behavior is typical. The marginal product curve for an input typically shows increasing marginal returns initially, and diminishing marginal returns at some point. **Diminishing marginal returns** describes a situation where the marginal product of an input decreases as additional units of that input are employed.
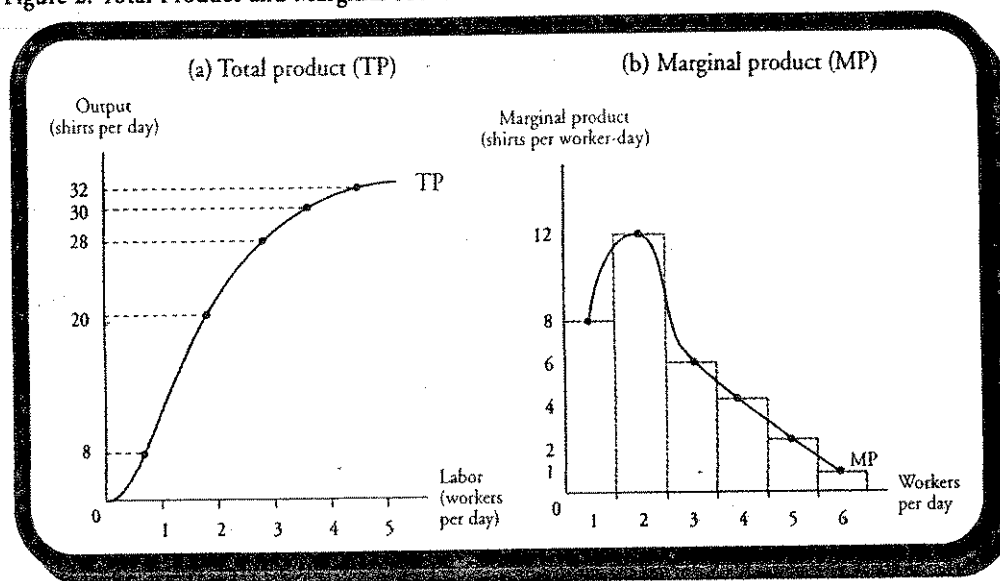
Figure 2: Total Product and Marginal Product

Figure 3 shows the relation between the average product curve for Sam's Shirts and the marginal product curve. Note in Figure 3 that average product is at its maximum at the point where the marginal product curve intersects it from above. For Sam's Shirts, this intersection occurs between two and three workers per day. Note that for the second worker, MP is greater than AP, but with three workers, MP is less than AP. This relationship is not unique to Sam's Shirts. Typically, marginal product exceeds average product up to some input quantity where they are equal. Beyond that point, marginal product is less than average product.

Figure 3: Average Product and Marginal Product of Labor
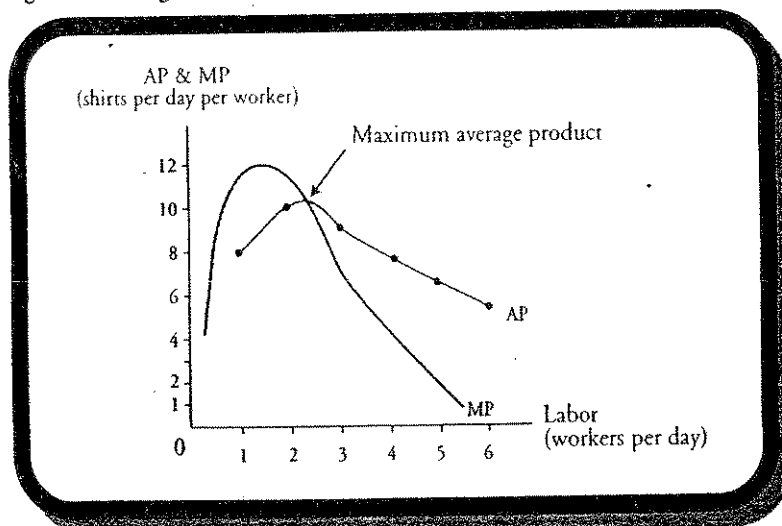
Short-Run Cost

To increase output in the short run, firms must use more labor, which increases cost. The relationship between output and cost may be explained in terms of three cost concepts: (1) total cost, (2) marginal cost, and (3) average cost.

Total cost, TC, is the sum of all costs associated with the generation of output. Total cost is made up of total *fixed* cost and total *variable* cost.

Total fixed cost, TFC, is the cost of fixed inputs, such as property, plant, and equipment, plus *normal profit*, i.e., the value of the entrepreneurial ability of the firm's owners or managers. Total fixed cost is independent of the level of the firm's output in the short run.

Total variable cost, TVC, is the cost of all variable production inputs. Total variable cost increases as output increases. The single biggest variable cost for most firms is the cost of labor (and raw materials for manufacturing firms).

   total cost = total fixed cost + total variable cost

Figure 4 illustrates the components of total cost for Sam's Shirts at different output levels. We will assume that Sam's fixed cost is $20 per day to rent one sewing machine. This amount will not change regardless of the quantity of shirts produced. So, the TFC curve is a horizontal line at $20 per day.

For simplicity, assume that labor is the only variable cost, and that Sam pays his workers $20 per day. So total variable cost will increase by $20 as each additional worker is required to increase output. Notice in Figure 4 that the vertical distance between the TVC and the TC curves is total fixed cost. It is also important to note that both TVC and TC are increasing. This is because TVC increases as output increases. Total cost at various levels of output for Sam's Shirts is tabulated in Figure 5.

Figure 4: Total Cost Curves
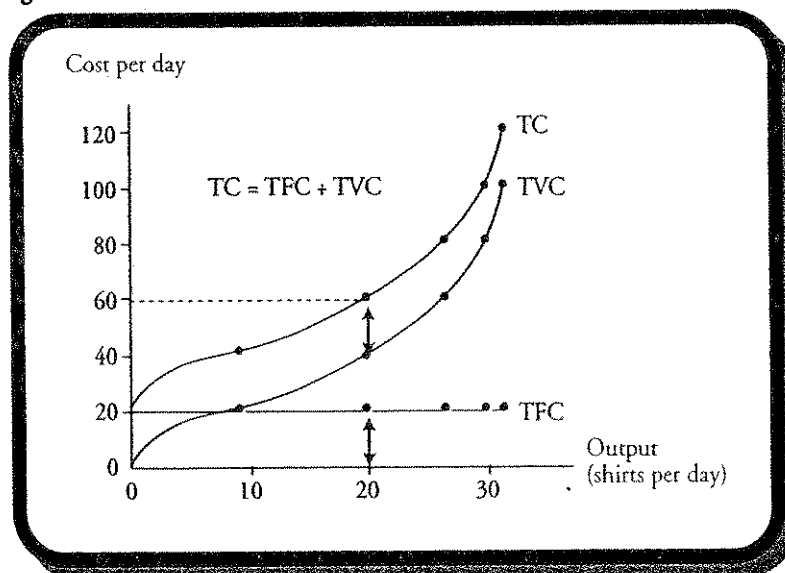
Notice that the TC and TVC curves in Figure 4 increase at an increasing rate. This behavior can be explained through a discussion of the concept of marginal cost.

Marginal cost, MC, is the increase in total cost for one additional unit of output. Since the addition of each worker results in multiple additional shirts, we divide the change in total cost by the increase in output to get the marginal cost amounts in Figure 5. That is:

$$\text{marginal cost} = \frac{\text{change in total cost}}{\text{change in output}}, \text{ or } MC = \frac{\Delta TC}{\Delta Q}$$

For Sam's Shirts, MC has been calculated and tabulated in Figure 5.

Figure 5: Total, Marginal, and Average Costs for Sam's Shirts

Output (Shirts)	Labor (workers/day)	TFC ($/day)	TVC	TC	MC ($/additional shirt)	AFC ($/shirt)	AVC	ATC
0	0	20	0	20	-----2.50-----			
8	1	20	20	40	----1.67-----	2.50	2.50	5.00
20	2	20	40	60	-----3.33-----	1.00	2.00	3.00
26	3	20	60	80		0.77	2.31	3.08
30	4	20	80	100	-----5.00-----	0.67	2.67	3.33
32	5	20	100	120	-----10.00-----	0.63	3.13	3.75

TFC = Total fixed cost	cost of fixed inputs; independent of output	
TVC = Total variable cost	cost of variable inputs; changes with output	
TC = Total cost		TC = TFC + TVC
MC = Marginal cost	change in total cost for one unit increase in output	MC = $\Delta TC / \Delta Q$
AFC = Average fixed cost		AFC = TFC / Q
AVC = Average variable cost		AVC = TVC / Q
ATC = Average total cost		ATC = AFC + AVC

Example: Marginal cost

Using the information for Sam's Shirts presented in Figure 5, calculate the marginal cost per shirt when output increases from 8 to 20 shirts per day.

Answer:

In Figure 5, we see that the change in TC when output increases from eight to 20 shirts is $60 – $40 = $20. Since the change in output is 20 – 8 = 12 shirts, the marginal cost can be calculated as:

MC = $20 / 12 shirts = $1.67 per shirt

Average cost is the average cost per unit of output at a given level of output. Since there are three types of costs, there are three corresponding average costs. These are:

- Average fixed cost, AFC, total fixed cost per unit of output.
- Average variable cost, AVC, total variable cost per unit of output.
- Average total cost, ATC, total cost per unit of output.

The individual average costs are calculated by dividing the total costs at a given level of output, Q, by that level of output. Mathematically, we have:

$$\frac{TC}{Q} = \frac{TFC}{Q} + \frac{TVC}{Q}, \text{ or } ATC = AFC + AVC$$

Average costs at the various output levels for Sam's have been calculated and tabulated in Figure 5. The marginal cost (MC) and average cost (ATC, AVC, and AFC) curves for Sam's Shirts are in Figure 6.

Figure 6: Average and Marginal Costs
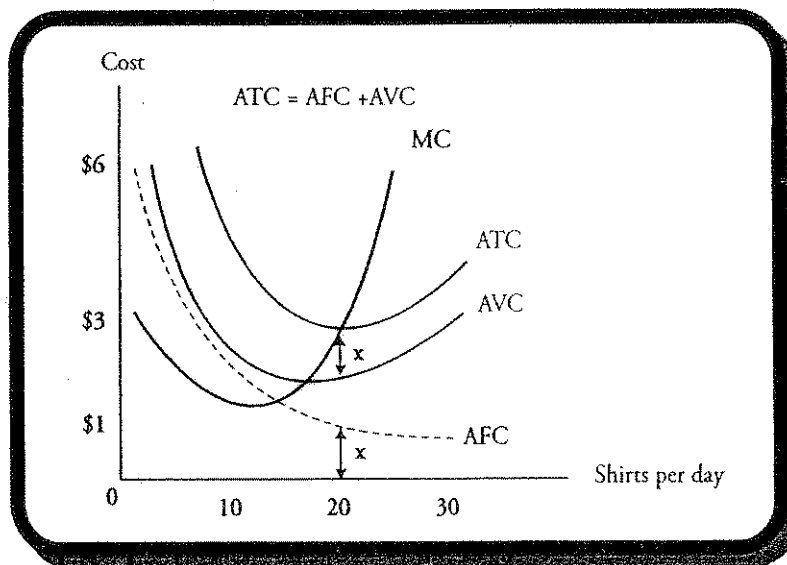
LOS 17.b: Explain the shape of the marginal cost curve and the average total cost curve, and explain the relationships between the different cost curves.

Important relationships among the marginal and average cost curves in Figure 6 are:

- *AFC slopes downward.* This is because fixed costs are constant, but are distributed over a larger and larger number of products as output quantity increases.
- *The vertical distance between the ATC and AVC curves is equal to AFC.* This is indicated by the arrows marked "x" at an output of 20 shirts per day.
- *MC declines initially, then increases.* At low output quantities, efficiencies are realized from the specialization of labor. However, as more and more labor is added, 'marginal cost increases. This is due to *diminishing returns*, which means that at some point, each added worker contributes less to total output than the previously added worker.
- *MC intersects AVC and ATC at their minimum points.* The intersection comes from below, which implies that when MC is less than ATC or AVC, respectively, ATC or AVC are decreasing, This also implies that when MC exceeds ATC or AVC, respectively, ATC or AVC are increasing.
- *ATC and AVC are U-shaped.* AVC decreases initially, but as output increases, the effect of diminishing returns sets in and AVC eventually slopes upward, giving the curve its U-shape. However, since fixed costs are spread out over a larger and larger quantity of output, AFC decreases as output increases, and eventually flattens out. ATC gets its U-shape because as output increases we are adding a curve that goes from downward

sloping to flat (AFC) to a U-shaped curve (AVC), which results in a U-shaped ATC curve. Remember, ATC = AVC + AFC.

The relationship between product curves and cost curves is illustrated in Figure 7, where average and marginal product curves for a firm are presented in panel (a), and marginal and average cost curves are presented in panel (b). Figure 7 illustrates the following important links between a firm's product curves (technology) and its cost curves.

- Over the initial increase in labor from zero to L_1 in panel (a), MP and AP increase and MP reaches its maximum. Over the corresponding output range in panel (b), MC and AVC decrease to output quantity Q_1 where MC is at a minimum. Note that L_1 is the labor required to produce Q_1.
- As labor increases from L_1 to L_2, and output increases from Q_1 to Q_2, AP continues to increase to a maximum at L_2 and AVC continues to fall to its minimum at Q_2. Over this same production range, MP is declining and MC is rising.
- As labor increases beyond L_2 and output increases beyond Q_2, MP and AP both decrease, and MC and AVC both increase.

Figure 7: Product and Cost Curves
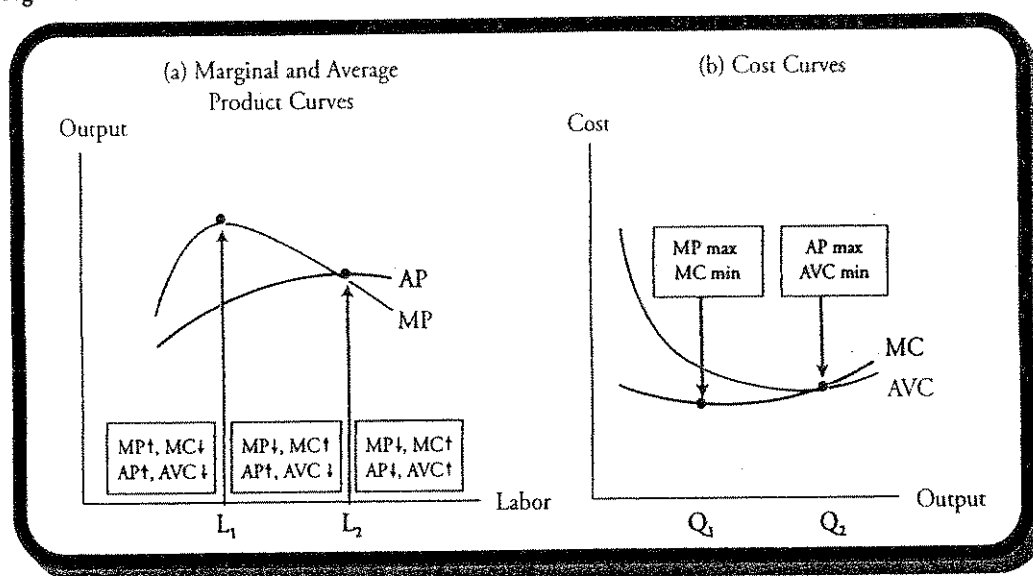
LOS 17.c: Discuss the concepts of diminishing returns and diminishing marginal product of capital.

The law of diminishing returns states that at some point, as more and more of one resource (e.g., labor) is added to the production process, holding the quantity of other inputs constant, the output continues to increase, but at a decreasing rate. For example, if an acre of corn needs to be picked, the addition of a second and third worker is highly productive. If you already have 300 workers in the field, the additional output from adding the 301st worker is lower than that of the second worker.

The *marginal product of capital* is the increase in output from using one additional unit of capital, holding the quantity of labor constant. Diminishing marginal product of capital means that at a constant level of labor, output increases as capital is added, but at some point, the increase in output from adding one more unit of capital begins to decrease.

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LOS 17.d: Explain the relationship between the long-run and short-run costs, and the different economies and diseconomies of scale.

Short-run cost curves apply to a plant of a given size. In the long run, everything is variable, including technology, plant size, and equipment. Long-run cost curves are known as *planning curves*. There is often a trade-off between the size of the firm and unit costs in the long run.

Three reasons unit cost may decline as output or plant size increase are:

- Savings due to mass production.
- Specialization of labor and machinery.
- Experience.

The downward sloping segment of the long-run average total cost curve presented in Figure 8 indicates that **economies of scale** are present. In this range increasing the scale (size) of the firm results in lower average unit costs. The upward sloping segment of this long-run average total cost curve indicates that diseconomies of scale are present when average unit costs rise as the scale of the business increases. The flat portion of the long-run average total costs curve in Figure 8 represents *constant returns to scale*. As shown, the optimal firm size (the one that will minimize average unit costs) is one which will produce Q* units of output.

Figure 8: Long-Run Average Total Cost
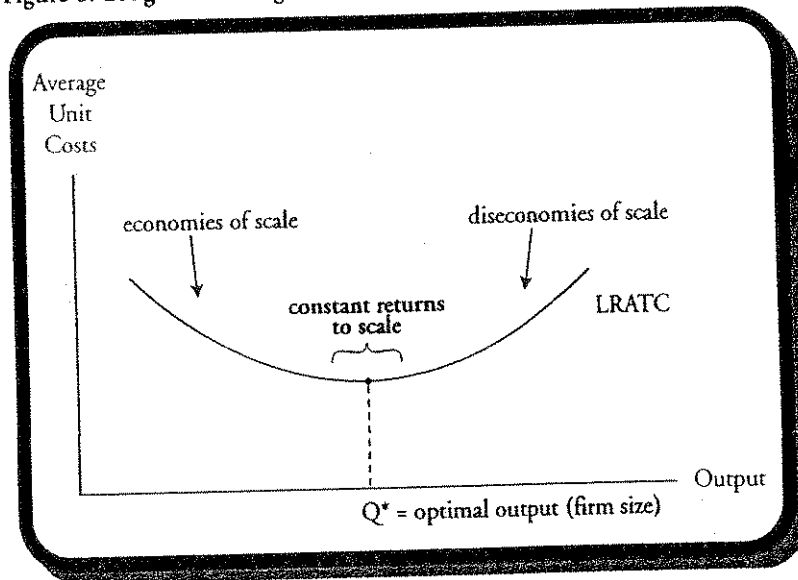
Diseconomies of scale may result as the increasing bureaucracy of larger firms leads to inefficiency, as well as from problems of motivating a larger work force, greater barriers to innovation and entrepreneurial activity, and increased principal-agent problems.

KEY CONCEPTS

1. Technology constraints arise from production capital and methods that cannot be changed in the short run.
2. Total product is the total output of goods.
3. Marginal product is the increase in total product from using one additional unit of input.
4. Average product is total output divided by the units of a variable input. The average product curve is at its maximum at the point where the marginal product curve intersects it from above.
5. Total cost is the sum of total fixed and total variable costs.
6. Total fixed cost is the cost of fixed inputs, such as property, plant, and equipment and it is independent of output. Total variable cost is the cost of all variable production inputs (e.g., labor) and it increases as output increases.
7. Marginal cost is the increase in total cost for a one unit increase in output.
8. As labor is added, marginal cost decreases at first, but eventually increases due to diminishing returns (diminishing marginal product).
9. There are three average costs:
   * Average fixed cost (AFC) is total fixed cost per unit of output.
   * Average variable cost (AVC) is total variable cost per unit of output.
   * Average total cost (ATC) is total cost per unit of output.

$$\frac{TC}{Q} = \frac{TFC}{Q} + \frac{TVC}{Q}, \text{ or } ATC = AFC + AVC$$

10. AFC slopes downward because fixed costs are constant, but are averaged over an increasing quantity of output.
11. The vertical distance between the ATC and AVC curves is equal to AFC.
12. The MC curve intersects the AVC and ATC curves at their minimum points from below. This implies that:
    * when MC is less than ATC or AVC, respectively, ATC or AVC are decreasing.
    * when MC exceeds ATC or AVC, respectively, ATC or AVC are increasing.
13. The AVC curve is U-shaped, declining at first due to efficiency gains, but eventually increasing due to diminishing returns. The ATC curve is U-shaped because it is the sum of the decreasing-to-flat AFC curve and the U-shaped AVC curve.
14. As labor and output increase, the MP curve reaches a maximum at the output where the MC curve is at its minimum.
15. As labor and output increase, AP reaches a maximum at the same output for which AVC is at a minimum.
16. The law of diminishing returns states that, at some point, using more of a variable input increases output at a decreasing rate when other inputs are held constant.
17. Diminishing marginal product of capital means that for a constant quantity of labor, output increases at a decreasing rate as more capital is employed.
18. Short-run cost curves are plant-size specific, whereas long-run cost curves show minimum average unit costs for different firm sizes (scale of operations).
19. Economies of scale are present when unit costs fall as plant size increases.
20. Diseconomies of scale are present when costs rise as plant size increases, often arising from the bureaucratic inefficiencies that occur with larger firms.

CONCEPT CHECKERS: OUTPUT AND COSTS

1. Which of the following *most accurately* describes the relationship between marginal product (MP) and average product (AP) of labor in the short run?
   A. AP is always less than MP.
   B. Initially, AP = MP, then AP > MP.
   C. Initially, AP < MP, then AP = MP, then AP > MP.
   D. Initially, AP > MP, then AP = MP, then AP < MP.

2. When marginal product is at a maximum:
   A. marginal cost is at a minimum.
   B. average product is at a minimum.
   C. average variable cost is increasing.
   D. average variable cost is at a minimum.

3. As a result of increasing labor from 100 to 110 workers, output increased from 1,250 to 1,550 units per day. The marginal product of an additional worker is *closest* to:
   A. 30 units per day.
   B. 1.55 units per day.
   C. 1.25 units per day.
   D. 300 units per day.

4. If both average product (AP) and marginal product (MP) are equal to 4 when 10 workers are employed, what can we *most likely* conclude about AP and MP when 15 workers are employed?
   A. AP = MP = 5.
   B. AP = 5 and MP = 6.
   C. AP = 4 and MP = 6.
   D. AP = 7 and MP = 5.

5. Which of the following *most accurately* describes the shapes of the average variable cost (AVC) curve and average total cost (ATC) curve?
   A. The AVC curve and the ATC curve are both U-shaped.
   B. The AVC and ATC curves both decrease initially, then flatten.
   C. The AVC curve is U-shaped; the ATC curve declines initially then flattens.
   D. The AVC curve declines initially then flattens; the ATC curve is U-shaped.

6. The vertical distance between the average total cost (ATC) curve and average variable cost (AVC) curve:
   A. increases as output increases.
   B. decreases as output increases.
   C. remains constant as output increases.
   D. increases and then decreases as output increases.

7. Which of the following *most accurately* describes the shape of the average fixed cost curve?
   A. It becomes relatively flat at large output levels.
   B. It is always below the average variable cost curve.
   C. It has the same shape as the average total cost curve.
   D. It intersects the marginal cost curve at its minimum.

8. Economies of scale:
    A. increase at a decreasing rate.
    B. are dependent on short-run average costs.
    C. occur when average unit costs fall with larger firm size.
    D. occur when the long-run average cost curve is sloping upward.

9. For a fixed level of capital, output increases as the quantity of labor increases, but at a decreasing rate. This phenomenon is *most accurately* described by the law of diminishing:
    A. returns to labor.
    B. costs to labor.
    C. returns to capital.
    D. returns to technology.

10. When average product is at a maximum:
    A. marginal cost is at a minimum.
    B. marginal product is increasing.
    C. marginal product is at a minimum.
    D. average variable cost is at a minimum.

ANSWERS – CONCEPT CHECKERS: OUTPUT AND COSTS

1. C   MP intersects the AP minimum from above. MP is initially greater than AP, and then MP and AP intersect. Beyond this intersection, MP is less than AP. (Hint: draw the curves.)

2. A   Marginal product is at a maximum when marginal cost is at a minimum. At the corresponding labor and output levels, average variable cost is decreasing and average product is increasing.

3. A   Marginal product is the change in output divided by the change in input (labor). Since output changed by 300 units and labor changed by 10 workers, the marginal product is 300 / 10 = 30 units per day.

4. D   For most production processes, as the quantity of labor increases, marginal product is initially greater than average product. Then at some level of labor input, the two curves intersect. Then beyond this intersection, marginal product is less than average product. So, beyond AP = MP = 4, MP must be less than AP. (Hint: draw the curves.)

5. A   The AVC curve is U-shaped, declining at first due to efficiency, but eventually increasing due to diminishing returns. The AFC curve decreases as output increases, and eventually flattens out. The ATC is U-shaped because it is the sum of the decreasing-to-flat AFC curve plus the U-shaped AVC curve. ATC = AFC + AVC.

6. B   The vertical distance between the average total cost curve and average variable cost curve is average fixed cost, which decreases as output increases because more output is averaged over the same cost.

7. A   Average fixed cost initially declines rapidly, but as output increases it flattens out, because fixed cost is being averaged over more and more units of output.

8. C   Economies of scale occur when the percentage increase in output is greater than the percentage increase in cost of all inputs. They occur when the long-run average cost curve slopes downward.

9. A   The law of diminishing returns states that at some point, as more and more of a resource (e.g., labor) is devoted to a production process, holding the quantity of other inputs constant, the output increases, but at a decreasing rate.

10. D   When average product is at a maximum, average variable cost is at a minimum. At the corresponding labor and output level, marginal product is decreasing and marginal cost is increasing.

PERFECT COMPETITION

EXAM FOCUS

You should be able to explain what a price-taker market is and how price and output are determined in the short run and the long run. Pay special attention to the relationship between marginal cost, marginal revenue, price, and output for a perfectly competitive firm. Know how the concept of economic profit applies to perfect competition. Finally, you should be able to explain the adjustments that take place in response to changes in industry demand. A good understanding of the case of perfect competition is important because this is the model of economically efficient markets to which we will compare other market structures in the reviews that follow.

LOS 18.a: Explain why firms in perfect competition are price takers, and discuss the relationship between demand, price and revenue.

Price takers are firms that face horizontal (perfectly elastic) demand curves. They can sell all of their output at the prevailing market price, but if they set their output price higher than the market price, they would sell nothing. They are price takers because they take the market price as given and do not have to devote any resources to discovering the best price at which to sell their product. A "price-taker market" is equivalent to a perfectly competitive market.

Perfect competition assumes the following:

- All the firms in the market produce identical products.
- There is a large number of independent firms.
- Each seller is small relative to the size of the total market.
- There are no barriers to entry or exit.

Producer firms in perfect competition have no influence over market price. Market supply and demand determine price. As illustrated in Figure 1, *the individual firm's* demand schedule is *perfectly elastic* (horizontal).

Figure 1: Price-Taker Demand
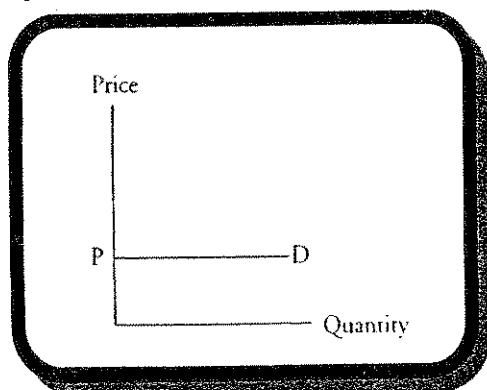
In a perfectly competitive market a firm will continue to expand production until marginal revenue, MR, equals marginal cost, MC. Marginal revenue is the increase in total revenue from selling one more unit of a good or

service. For a price taker, marginal revenue is simply price because all additional units are assumed to be sold at the same (market) price. In *pure competition*, a firm's marginal revenue is equal to the market price and a firm's MR curve, presented in Figure 2, is identical to the demand curve.

Figure 2: Marginal Revenue Curve
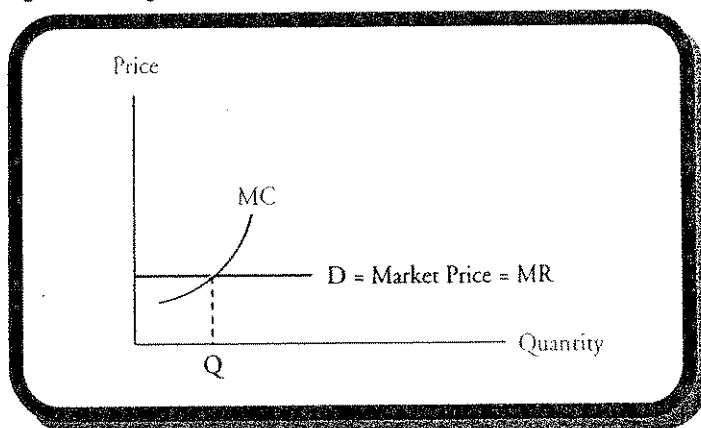
LOS 18.b: Discuss how the firm maximizes profit in perfect competition, analyze the marginal costs and revenue, and the concepts of economic profit and loss.

All firms maximize (economic) profit by producing and selling the quantity for which marginal revenue equals marginal cost. For a price taker in a perfectly competitive market, this is the same as producing and selling the output for which marginal revenue equals (market) price. Economic profit equals total revenues less the opportunity cost of production, which includes the cost of a normal return to all factors of production, including invested capital.

Figure 3(a) illustrates that in the *short run*, economic profit is maximized when marginal revenue = marginal cost = price, or MR = MC = P. As shown in Figure 3(b), profit maximization also occurs when total revenue exceeds total cost by the maximum amount.

An *economic loss* occurs if marginal revenue is less than marginal cost. The firm will be generating losses on its marginal production and will reduce output to where MR = MC.

Figure 3: Short-Run Profit Maximization
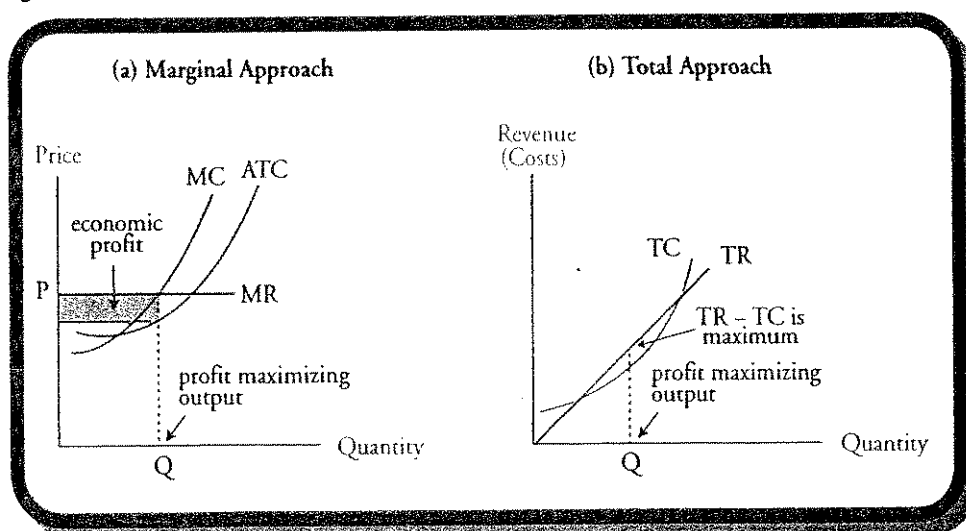
In a perfectly competitive market, a firm will not earn economic profits for any significant period of time. The assumption is that new firms (with average and marginal cost curves identical to those of existing firms) will enter the industry to earn profits, increasing market supply and eventually reducing market price so that it just equals a firm's average total cost (ATC). In equilibrium, each firm is producing the quantity for which P = MR = MC = ATC, so that no firm earns economic profits and each firm is producing the quantity for which ATC is a minimum (the quantity for which ATC = MC). This is illustrated in Figure 4.
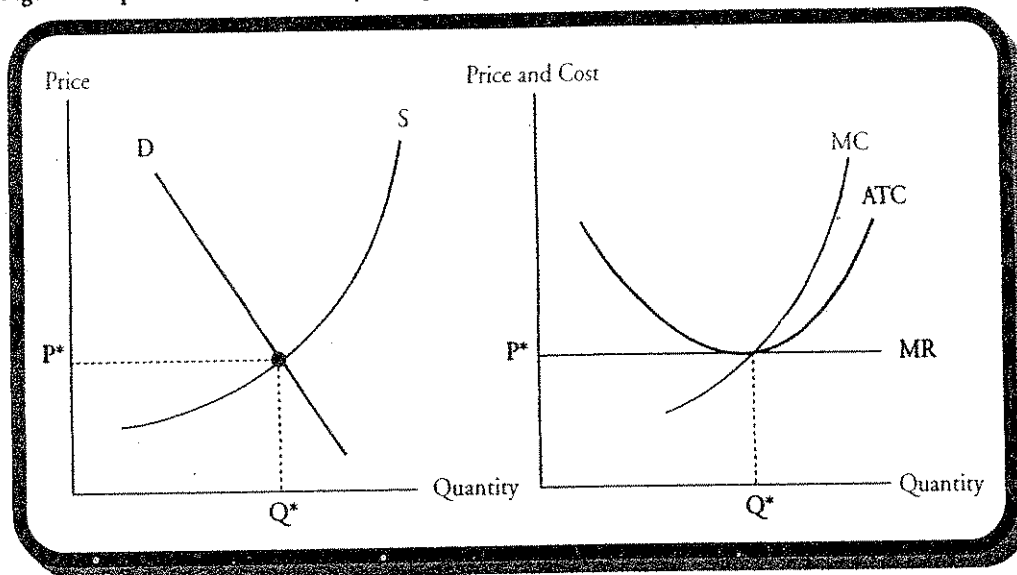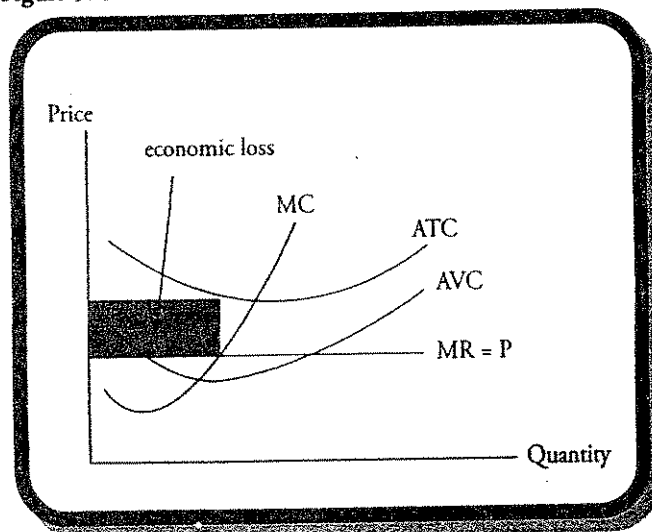
Figure 4: Equilibrium in a Perfectly Competitive Market

Figure 5 illustrates that firms will experience economic losses when price is below average total cost (P < ATC). In this case, the firm must decide whether to continue operating. A firm will minimize its losses in the short run by continuing to operate when P < ATC but P > AVC. As long as the firm is covering its variable costs and some of its fixed costs, its loss will be less than its fixed (in the short run) costs. If the firm is not covering its variable costs (P < AVC) by continuing to operate, its losses will be greater than its fixed costs. In this case, the firm will shut down (zero output) and lay off its workers. This will limit its losses to its fixed costs (e.g., its building lease and debt payments). If the firm does not believe price will ever exceed ATC in the future, going out of business is the only way to eliminate fixed costs.

Figure 5: Short-Run Loss

The *long-run equilibrium output* level for perfectly competitive firms is where MR = MC = ATC, which is where ATC is at a minimum. At this output, economic profit is zero and only a normal return is realized.

LOS 18.c: Distinguish between the firm's and the industry's short-run supply curve, and explain the relationship between the two.

Recall that price takers should produce where P = MC. Referring to Figure 6(a), a firm will shut down at a price below P_1. Between P_1 and P_2 a firm will continue to operate in the short run. At P_2 the firm is earning a normal profit—economic profit equals zero. At prices above P_2, a firm is making economic profits and will expand its production along the MC line. Thus, the short-run supply curve for a firm is its MC line above the average variable cost curve, AVC. The supply curve shown in Figure 6(b) is the short-run market supply curve, which is the horizontal sum (add up the quantities from all firms at each price) of the MC curves for all firms in a given industry. Since firms will supply more units at higher prices, the short-run market supply curve slopes upward to the right.

Figure 6: Short-Run Supply Curves
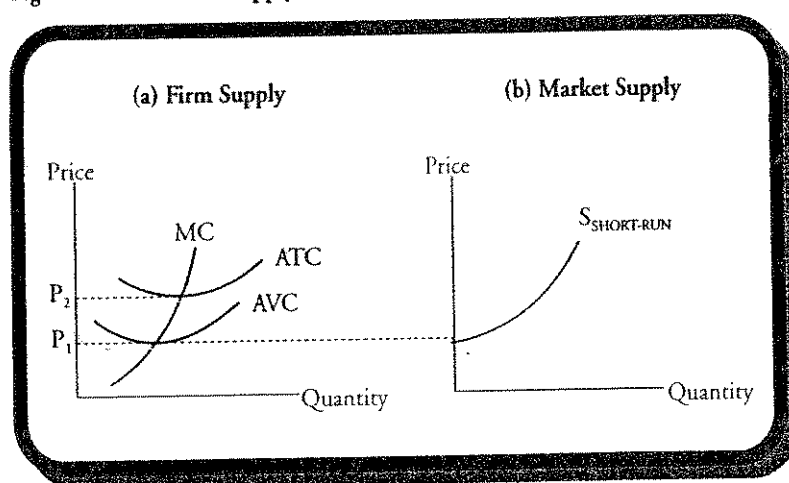
LOS 18.d: Explain the relationship between the firm's marginal cost, marginal revenue, and price when a firm in perfect competition produces the quantity that maximizes profit.

The profit-maximizing output for a competitive firm (price taker) is the output for which marginal revenue equals marginal cost. Since the demand curve faced by each firm in perfect competition is horizontal, marginal revenue is equal to price. For each additional unit the firm sells, its total revenue increases by the price of a unit.

LOS 18.e: Discuss the impact of changes in demand, long-run adjustments, entry and exit, and changes in plant size on the long-run equilibrium.

In the short run, an increase in demand (a shift of the market demand curve to the right) will increase both equilibrium price and quantity, while a decrease in demand will reduce both equilibrium price and quantity. The change in equilibrium price will change the (horizontal) demand curve faced by each individual firm and the profit-maximizing output of a firm. These effects for an increase in demand are illustrated in Figure 7, where we can see that an increase in market demand from D_1 to D_2 increases the short-run equilibrium price from P_1 to P_2 and equilibrium output from Q_1 to Q_2. In Figure 7(b), we see the short-run effect of the increased market price on the output of an individual firm. The higher price leads to a greater profit-maximizing output, Q_{2Firm}. At the higher output level, a firm will earn an economic profit in the short run. So, faced with increased demand, some firms will increase their scale of operations, and new firms will likely enter the industry. On the other hand, when firms are faced with a decrease in demand, the short-run equilibrium price and quantity will fall, and firms will decrease their scale of operations or exit the market.

Figure 7: Short-Run Adjustment to an Increase in Demand Under Perfect Competition
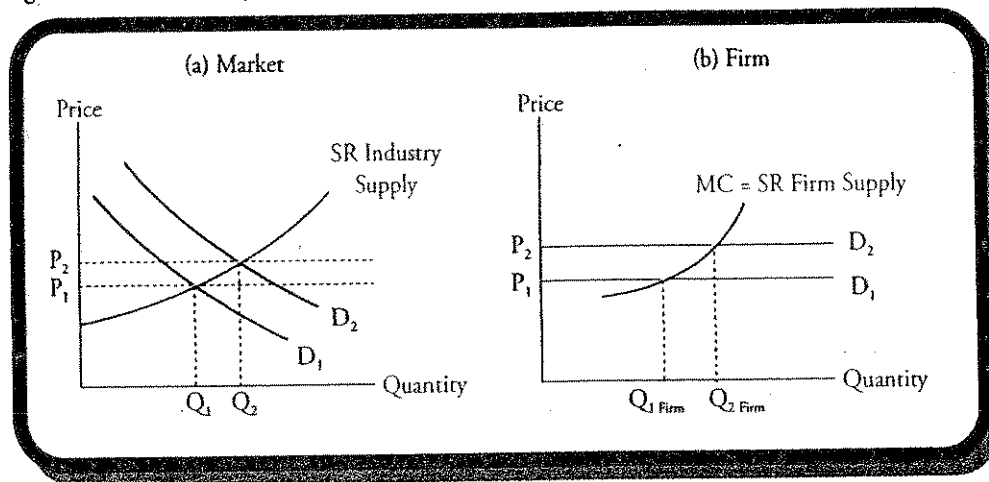
A firm's long-run adjustment to a shift in industry demand and the resulting change in price may be either to alter the size of its plant or leave the market entirely. The marketplace abounds with examples of firms that have increased their plant sizes (or added additional production facilities) to increase output in response to increasing market demand. Other firms, such as Ford and GM, have decreased plant size to reduce economic losses. This strategy is commonly referred to as *downsizing*.

If an industry is characterized by firms earning economic profits, new firms will enter the market. This will cause industry supply to increase (the industry supply curve shifts downward and to the right), increasing equilibrium output and decreasing equilibrium price. Even though industry output increases, however, individual firms will produce less because as price falls, each individual firm will move down its own supply curve. The end result is that a firm's total revenue and economic profit will decrease.

If firms in an industry are experiencing economic losses, some of these firms will exit the market. This will decrease industry supply and increase equilibrium price. Each remaining firm in the industry will move up its individual supply curve and increase production at the higher market price. This will cause total revenues to increase, reducing any economic losses the remaining firms had been experiencing.

LOS 18.f: Discuss how a permanent change of demand or changes in technology impact price, output, and economic profit.

A *permanent change in demand* leads to the entry of firms to or exit of firms from an industry. Let's consider the permanent increase in demand illustrated in Figure 8. The initial long-run industry equilibrium condition shown in Figure 8(a) is at the intersection of demand curve D_0 and supply curve S_0, at price P_0 and quantity Q_0. As indicated in Figure 8(b), at the market price of P_0 each firm will produce q_0. At this price and output, each firm earns a normal profit, and economic profit is zero. That is, $MC = MR = P$ and ATC is at its minimum. Now, suppose industry demand permanently increases such that the industry demand curve in Figure 8(a) shifts to D_1. The new market price will be P_1 and industry output will increase to Q_1. At the new price P_1, existing firms will produce q_1 and realize an economic profit since $P_1 > ATC$. Positive economic profits will cause new firms to enter the market. As these new firms increase total industry supply, the industry supply curve will gradually shift to S_1, and the market price will decline back to P_0. At the market price of P_0, the industry will now produce Q_2, with an increased number of firms in the industry, each producing at the original quantity, q_0. The individual firms will no longer enjoy an economic profit since $ATC = P_0$ at q_0.

Figure 8: Effects of a Permanent Increase in Demand
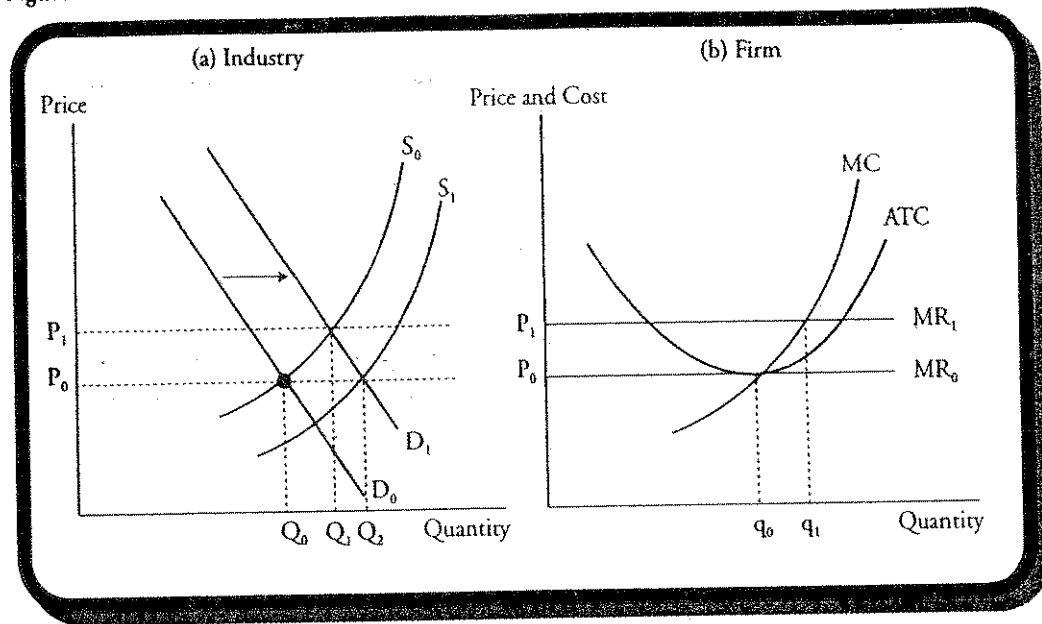
Technological changes, such as a lower-cost production process, usually require firms to invest in additional fixed assets (e.g., plant and equipment). Consequently, technological advances take some time to become common practice throughout an industry. Once individual firms have implemented technological changes, their costs decline and their supply (cost) curve shifts to the right. At the lower costs, firms are willing to supply a given quantity at a reduced price, or provide more of a product at a higher price. In either case, the lower cost structure for the individual firms shifts the industry supply curve to the right. With a given demand, and this repositioned industry supply curve, the industry supplies more of a given product at a lower price.

Firms that are the first to adopt the new cost-reducing technology will earn economic profits. New firms that use the new technology will be attracted to the industry by profits. Existing firms using the older (higher-cost) technology will experience economic losses and be forced to either adopt the new technology or exit the industry. Long-run equilibrium with price equal to minimum average total cost for the new technology will be established after all firms in the industry have adopted the new technology. In long-run equilibrium, firms again will earn zero economic profits as the number of firms in the industry will be the number for which total industry supply makes equilibrium price equal to minimum average total cost (and marginal cost) for each firm.

KEY CONCEPTS

1. Price takers are firms that take the market price as given; they face perfectly elastic (horizontal) demand curves.

2. Conditions of purely competitive markets:
   * All the firms in the market produce a homogeneous product.
   * There is a large number of independent firms.
   * Each seller is small relative to the total market.
   * There are no barriers to entry or exit.

3. For price takers, $MR = P$ and $TR = P \times Q$. Price takers will maximize profits when $MR = MC$, so the operative rule for profit maximization by price-taker firms is $P = MC$.

4. For a price-taker firm, if price is temporarily less than ATC but above AVC, the firm should continue to operate, but should shut down temporarily if price is less than AVC. A firm that believes price will always be less than ATC should go out of business.

5. Economic profit equals total revenues less the opportunity cost of production, which includes normal profits.

6. The long-run equilibrium output level for perfectly competitive firms is where $MR = MC = ATC$, which is where ATC is at a minimum.

7. An increase (decrease) in market demand will increase (decrease) equilibrium price and output as the higher (lower) price increases (decreases) the profit-maximizing output of individual firms.

8. A permanent increase (decrease) in demand leads to an increase (decrease) in the number of firms in the market.

9. Firms that are among the first to adopt new cost-saving technology will expand output and earn economic profits. When all industry firms have adopted the new technology, industry supply will be greater, equilibrium price lower, and equilibrium output higher. Price will again equal MC and minimum ATC for each firm, and economic profit will be zero.

CONCEPT CHECKERS: PERFECT COMPETITION

1. A firm operating under conditions of pure competition will:
    A. be a price-searcher.
    B. face a vertical demand curve.
    C. generate zero economic profit in the long run.
    D. produce a quantity where marginal revenue is less than marginal cost.

2. Under pure competition, a firm will experience economic losses when:
    A. MC is less than ATC.
    B. MR is greater than ATC.
    C. MC = ATC = MR = price.
    D. price is less than ATC.

3. A price-taker firm will increase output as long as:
    A. marginal revenue is positive.
    B. marginal cost is less than average cost.
    C. marginal revenue is greater than marginal cost.
    D. marginal revenue is greater than the average cost.

4. Which of these statements is *most accurate* regarding the characteristics of a perfectly competitive market?
    A. Firms' products are different.
    B. There are more buyers than there are sellers.
    C. The competitors never earn economic profits.
    D. Barriers to entry into the market are nonexistent.

5. Under perfect competition, the long-run equilibrium condition for a firm may be described as:
    A. TC = TR = P.
    B. P = ATC = TR.
    C. MC = TR = TC.
    D. P = MC = ATC.

6. When a firm operates under conditions of pure competition, marginal revenue always equals:
    A. price.
    B. total revenue.
    C. average fixed cost.
    D. average variable cost.

7. A firm is likely to continue production in the short run as long as price is at least equal to:
    A. marginal cost.
    B. average fixed cost.
    C. average total cost.
    D. average variable cost.

8. A purely competitive firm will tend to expand its output so long as:
    A. its marginal revenue is positive.
    B. the marginal revenue is greater than price.
    C. the market price is greater than marginal cost.
    D. the marginal cost is greater than marginal revenue.

9.   The demand for the product of a purely competitive firm is:
       A. perfectly elastic.
       B. perfectly inelastic.
       C. greater than zero but less than one.
       D. dependent upon the availability of substitute products.

10.   In a purely competitive market, economic losses indicate that:
       A. collusion is occurring in the market place.
       B. firms need to expand output to reduce costs.
       C. the industry is operating normally and production is at its efficient level.
       D. price is below average total costs.

ANSWERS – CONCEPT CHECKERS: PERFECT COMPETITION

1. C   A firm operating under conditions of pure competition will generate zero economic profit in the long run. In the short run, firms may generate economic profits. However, because of the lack of entry barriers, new competitors will enter the market and prices will adjust downward until economic profits disappear.

2. D   Under pure competition, a firm will experience losses when its selling price is less than average total cost. The other possible answers will not necessarily result in losses.

3. C   A firm will increase output, as long as MR > MC.

    Professor's Note: Don't forget that economic profit is the firm's total revenues less its opportunity cost.

4. D   The only true statement listed in the question is that, under pure competition, there are no barriers to entry into the market. Each of the other possible answers is incorrect. The answer "competitors never earn economic profits" is incorrect because price-taker firms can earn positive economic profits in the short run.

5. D   For a competitive firm, long-run equilibrium is where P = MC = ATC. For price-taker firms, P = MR. Competition eliminates economic profits in the long run so that P = ATC.

6. A   When a firm operates under conditions of pure competition, MR always equals price. This is because, in pure competition, demand is perfectly elastic (a horizontal line) so MR is constant and equal to price.

7. D   If price is greater than average variable cost, a firm will continue to operate in the short run since it is covering at least some of its fixed costs.

8. C   A purely competitive firm will tend to expand its output so long as the market price is greater than MC. In the short term and long term, profit is maximized when P = MC.

9. A   The demand for the product of a purely competitive firm is perfectly elastic. This is true because the market dictates price. If a price taker increases its price above the market price, the firm will sell no units.

10. D   In a purely competitive market, economic losses indicate that firms are overproducing, causing prices to fall below average total costs. This can occur in the short run. In the long run, however, market supply will decrease as firms exit the industry, and prices will rise to the point where economic profits are zero.

MONOPOLY

EXAM FOCUS

Be able to identify the key features of a monopoly and how natural monopolies arise. Know the relationship between price, marginal revenue, average cost, and marginal cost for a monopoly and why monopolies restrict output to an economically inefficient quantity compared to pure competition. Understand the social benefit of regulation imposing average cost pricing and why marginal cost pricing for a natural monopoly requires a subsidy.

LOS 19.a: Discuss the characteristics of a monopoly, how they arise, the key features, and monopoly price strategies.

A **monopoly** is characterized by one seller of a specific, well-defined product that has *no good substitutes*. For a firm to maintain its monopoly position it must be the case that *barriers to entry to the market are high*.

Barriers to entry are factors that make it difficult for competing firms to enter a market. There are two types of barriers to entry that can result in a monopoly, legal barriers and natural barriers.

Legal Barriers

Most legal barriers to entry do not result in actual monopolies. Restrictions on broadcast licenses for radio and television stations granted by the Federal Communications Commission in the U.S. present significant barriers to entry. Within each market, however, several such licenses are granted, so no one station has a monopoly on radio or television broadcasts. Such restrictions also offer an example of how market power of firms protected from competition by legal restrictions can erode over time as substitute products are developed. The introduction of cable television, satellite television, and, most recently, satellite radio have all significantly eroded the protection offered by possessing a local broadcast license.

Patents, copyrights, and government granted franchises are legal barriers to entry that can result in a single, monopoly, producer of a good in a market. U.S. laws give the U.S. Postal System the exclusive right to deliver mail (although substitute products have been introduced) and local laws grant exclusive rights to water, electric and other utilities. Patents give their owners the exclusive right to produce a good for a period of years just as copyright protection is offered to the creators of original material. Pharmaceutical firms, semiconductor firms, and software creators are a few of the types of firms that enjoy such protection from competition.

Natural Barriers

In some industries, the economics of production lead to a single firm supplying the entire market demand for the product. When there are large *economies of scale*, it means that the average cost of production decreases as a single firm produces greater and greater output. An example is an electric utility. The fixed costs of producing electricity and building the power lines and related equipment to deliver it to homes are quite high. The marginal cost of providing electricity to an additional home or of providing more electricity to a home is, however, quite low. The more electricity provided, the lower the average cost per kilowatt hour. When the average cost of production for a single firm is falling throughout the relevant range of consumer demand, we say that the industry is a **natural monopoly**. The entry of another firm into the industry would divide the production

between two firms and result in a higher average cost of production than for a single producer. Thus, large economies of scale in an industry present significant barriers to entry.

A monopoly faces a downward sloping demand curve for its product so profit maximization involves a trade-off between price and quantity sold if the firm sells at the same price to all buyers. Assuming a single selling price, a monopoly firm must lower its price in order to sell a greater quantity. Unlike a firm in perfect competition, a firm facing a downward sloping demand curve must determine what price to change, hoping to find the price and output combination that will bring the maximum profit to the firm.

LOS 19.b: Explain the relationship between price, marginal revenue, and marginal cost for a monopoly.

To maximize profit, monopolists will expand output until marginal revenue (MR) equals marginal cost (MC). Due to high entry barriers, monopolist profits do not attract new market entrants. Therefore, long-run positive economic profits can exist. Do monopolists charge the highest possible price? The answer is no, because monopolists want to maximize profits, not price.

Figure 1 shows the revenue-cost structure facing the monopolist. Note that production will expand until MR = MC at optimal output Q*. To find the price at which it will sell Q* units you must go to the demand curve. The demand curve itself does not determine the optimal behavior of the monopolist. Just like the perfect competition model, the profit maximizing output for a monopolist is where MR = MC. To ensure a profit, the demand curve must lie above the firm's average total cost (ATC) curve at the optimal quantity so that price > ATC.

Figure 1: Monopolistic Short-Run Costs and Revenues
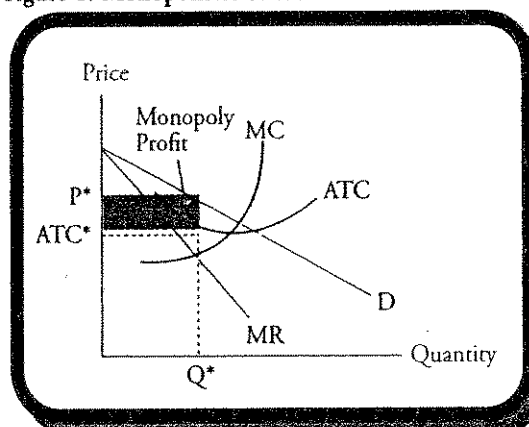
Once again, the *profit maximizing* output for a monopolistic firm is the one for which MR = MC. As shown in Figure 1, the profit maximizing output is Q*, with a price of P*, and an economic profit equal to $(P* - ATC*) \times Q*$.

Monopolists are *price searchers* and have *imperfect information* regarding market demand. They must experiment with different prices to find the one that maximizes profit.

LOS 19.c: Distinguish between monopoly and perfect competition, explain why a monopoly can set a higher price, and why a monopoly is considered inefficient.

Figure 2 illustrates the difference in allocative efficiency between monopoly and perfect competition. Under *perfect competition*, the industry supply curve, S, is the sum of the supply curves of the many competing firms in the industry. The perfect competition equilibrium price and quantity are at the intersection of the industry supply curve and the market demand curve, D. The quantity produced is Q_{PC} at an equilibrium price P_{PC}. Since

each firm is small relative to the industry, there is nothing to be gained by attempting to decrease output in an effort to increase price.

A monopolist facing the same demand curve, and with the same marginal cost curve, MC, will maximize profit by producing Q_{MON} (where MC = MR) and charging a price of P_{MON}.

The important thing to note here is that when compared to a perfectly competitive industry, the monopoly firm will produce less total output and charge a higher price.

Recall from our review of perfect competition that the efficient quantity is the one for which the sum of consumer surplus and producer surplus is maximized. In Figure 2, this quantity is where S = D, or equivalently, where marginal cost (MC) = marginal benefit (MB). *Monopoly is considered to be inefficient* relative to perfect competition because monopolies produce a quantity that does not maximize the sum of consumer surplus and producer surplus.

Figure 2: Perfect Competition Versus Monopoly
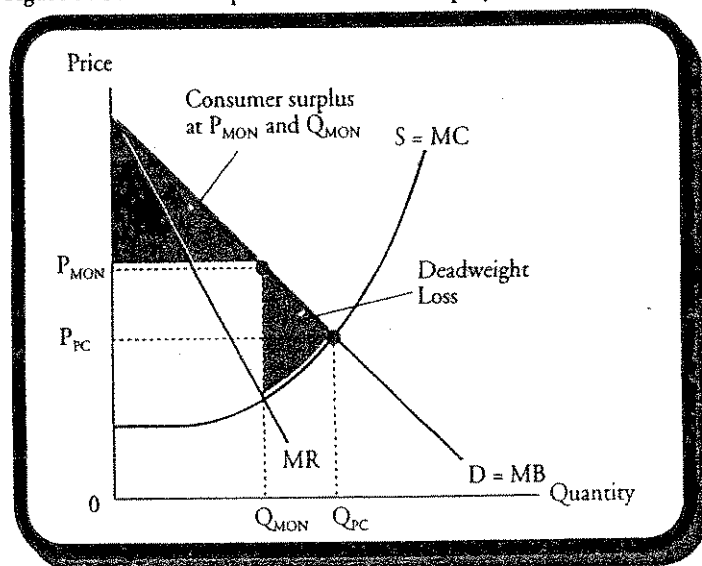
LOS 19.d: Explain the concepts of price discrimination.

Price discrimination is the practice of charging different consumers different prices for the same product or service. Examples are different prices for airline tickets based on whether a Saturday-night stay is involved (separates business travelers and leisure travelers) and different prices for movie tickets based on age.

The motivation for a monopolist is to capture more consumer surplus as economic profit than is possible by charging a single price.

For price discrimination to work, the seller must:

- Face a downward-sloping demand curve.
- Have at least two identifiable groups of customers with *different price elasticities of demand* for the product.
- Be able to prevent the customers paying the lower price from reselling the product to the customers paying the higher price.

As long as these conditions are met, firm profits can be increased through price discrimination.

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Figure 3 illustrates how price discrimination can increase the total quantity supplied and increase economic profits. For simplicity, we have assumed no fixed costs and constant variable costs so that MC = ATC. In panel (a) the single profit-maximizing price is $100 at a quantity of 80 (where MC = MR), which generates a profit of $2,400. In panel (b) the firm is able to separate consumers, charges one group $110 and sells them 50 units, and sells an additional 60 units to another group (with more elastic demand) at a price of $90. Total profit is increased to $3,200 and total output is increased from 80 units to 110 units.

Compared to the quantity produced under perfect competition, the quantity produced by a monopolist reduces the sum of consumer and producer surplus by an amount represented by the triangle labeled *deadweight loss* in Figure 2. Consumer surplus is reduced not only by the decrease in quantity but also by the increase in price relative to perfect competition. Monopoly is considered inefficient because the reduction in output compared to perfect competition reduces the sum of consumer and producer surplus. Since marginal benefit is greater than marginal cost, less than the efficient quantity of resources are allocated to the production of the good. Price discrimination reduces this inefficiency by increasing output toward the quantity where marginal benefit equals marginal cost. Note that the deadweight loss (DWL) is smaller in panel (b). The firm gains from those customers with inelastic demand while still providing goods to customers with more elastic demand. This may even cause production to take place when it would not otherwise.

An extreme (and largely theoretical) case of price discrimination is perfect price discrimination. If it were possible for the monopolist to charge each consumer the maximum they are willing to pay for each unit, there would be no deadweight loss, since a monopolist would produce the same quantity as under perfect competition. With perfect price discrimination there would be no consumer surplus. It would all be captured by the monopolist.

Figure 3: Effect of Price Discrimination on Output and Operating Profit
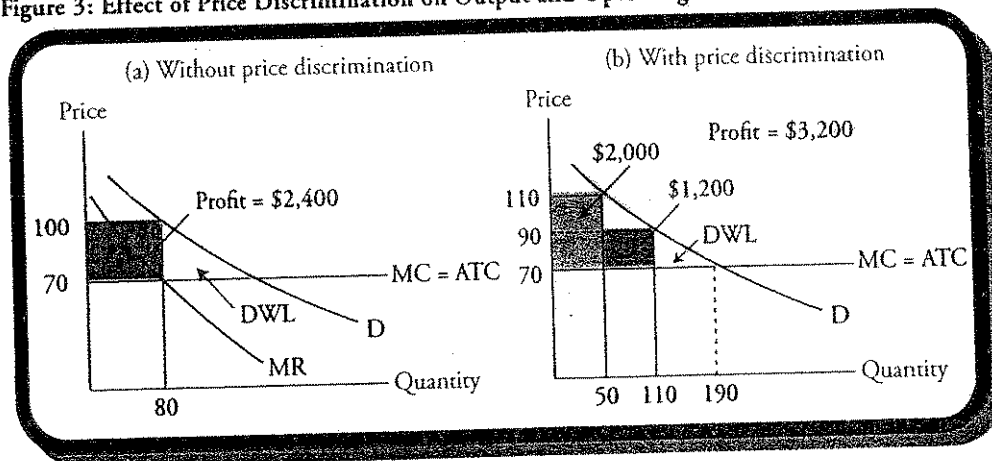
LOS 19.e: Discuss the reasons why a monopoly exists, how economies of scope and economies of scale can be achieved, and discuss the issues surrounding regulation of a natural monopoly.

Recall that a *natural monopoly* is an industry in which economies of scale are so pronounced that the ATC of total industry production is minimized when there is only one firm. Here, average total cost is declining over the entire range of relevant outputs. Fixed costs are high and marginal costs are quite low. We illustrate the case of a natural monopoly in Figure 4. Left unregulated, a single-price monopolist will maximize profits by producing where MR = MC, producing quantity Q_U and charging P_U. Given the economies of scale, having another firm in the market would increase the ATC significantly. Note in Figure 4 that if two firms each produced approximately one-half of output Q_{AC}, average cost for each firm would be much higher than for a single producer producing Q_{AC}.

Economies of scope can also lead to a natural monopoly, especially in an industry where economies of scale also exist. Economies of scope occur when a firm expands the range of goods it produces such that its average total

cost is reduced. A firm such as Boeing uses very specialized equipment and computer programs to engineer the many parts that go into an airplane. This means that it can produce these components at a lower average cost than individual suppliers could.

Regulators often attempt to increase competition and efficiency through efforts to reduce artificial barriers to trade, such as licensing requirements, quotas, and tariffs.

Since monopolists produce less than the optimal quantity (do not achieve efficient resource allocation), government regulation may be aimed at improving resource allocation by regulating the prices monopolies may charge. This may be done through **average cost pricing** or **marginal cost pricing**.

Average cost pricing is the most common form of regulation. This would result in a price of P_{AC} and an output of Q_{AC} as illustrated in Figure 4. It forces monopolists to reduce price to where the firm's ATC intersects the market demand curve. This will:

* Increase output and decrease price.
* Increase social welfare (allocative efficiency).
* Ensure the monopolist a *normal* profit since price = ATC.

Marginal cost pricing forces the monopolist to reduce price to the point where the firm's MC curve intersects the market demand curve, which increases output and reduces price but causes the monopolist to incur a loss since price is below ATC, as illustrated in Figure 4. Such a solution requires a government subsidy in order to provide the firm with a normal profit and prevent it from leaving the market entirely.

Regulators sometimes go astray when dealing with the problems associated with markets with high barriers to entry. The reasons for this include:

* *Lack of information.* Regulators may not know the firm's ATC, MC, or demand schedule.
* *Cost shifting.* The firm has no incentive to reduce costs, since this will cause the regulators to reduce price. If the firm allows costs to rise, the regulator will allow prices to increase.
* *Quality regulations.* It is easier to regulate price than it is to regulate quality. If the firm faces falling profits due to a cost squeeze, it may reduce the quality of the good or service.
* *Special interest effect.* The firm may try to influence regulation by political manipulation designed to influence the composition and decisions of the regulatory board.

Figure 4: Natural Monopoly—Average Cost and Marginal Cost Pricing
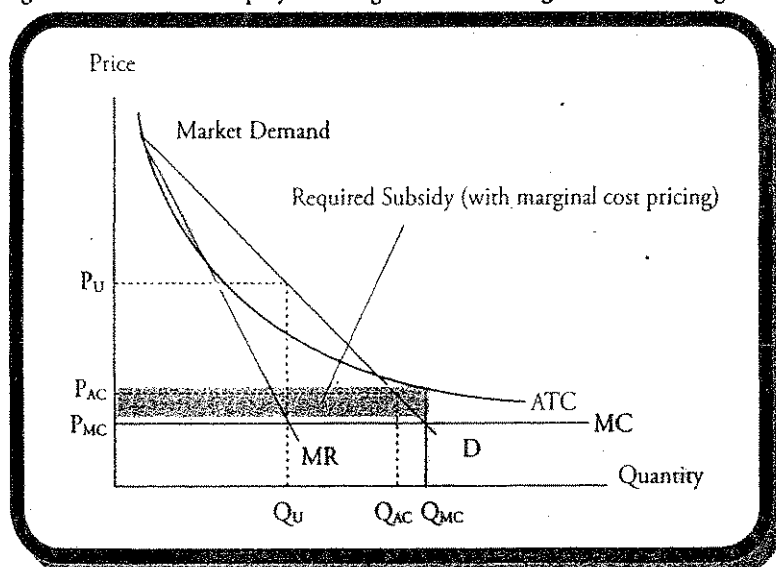
KEY CONCEPTS

1. Monopoly is characterized by one seller of a specific, well-defined product that has no good substitutes and high barriers to entry.
2. Barriers to entry include economies of scale, government licensing and legal barriers, patents or exclusive rights of production, and resource control.
3. Monopolists maximize profit by producing the quantity where MR = MC.
4. Monopolists are price searchers (face downward sloping demand curves) with imperfect information about demand, so they must experiment with different prices to find the profit maximizing price and output quantity.
5. Compared to perfect competition, monopolies produce less total output, charge a higher price, and do not achieve allocative efficiency because the sum of consumer surplus and producer surplus is not maximized.
6. Price discrimination will increase both output and monopoly profits when there are at least two identifiable groups of customers with different price elasticities of demand, and the monopolist can prevent low-price-paying customers from reselling to high-price-paying customers.
7. A natural monopoly exists when economies of scale are so pronounced that ATC is falling (MC < ATC) over the relevant output range so that the cost of total industry production is minimized when there is only one firm in the industry.
8. With average cost pricing, the most common form of regulation, regulators attempt to force monopolists to charge a price equal to ATC where the market demand curve intersects the ATC curve.
9. Marginal cost pricing forces a monopolist to charge a price equal to MC where the firm's MC curve intersects the market demand curve, increasing output and reducing price but requiring a government subsidy since price is then less than ATC.

CONCEPT CHECKERS: MONOPOLY

1. A monopolist will expand production until MR = MC and charge a price determined by the:
    A. marginal cost curve.
    B. marginal revenue curve.
    C. demand curve.
    D. average total cost curve.

2. Which one of the following statements *most accurately* describes a significant difference between a monopoly firm and a perfectly competitive firm? A perfectly competitive firm:
    A. minimizes costs; a monopolistic firm maximizes profit.
    B. maximizes profit; a monopolistic firm maximizes price.
    C. takes price as given; a monopolistic firm must search for the best price.
    D. does not seek to maximize profit because profits are forced to zero in the long run; a monopoly firm will maximize profits.

3. A natural monopoly may exist when:
    A. ATC increases as output increases.
    B. economies of scale are great.
    C. expensive natural resources are used in production.
    D. all production is divided up between just a few firms.

4. A monopolist will maximize profits by:
    A. setting the price as high as possible.
    B. producing at the point where price is equal to MC.
    C. producing at the output level where MR equals ATC and charging a price along the demand curve that corresponds to the output rate.
    D. producing at the output level where MR equals MC and charging a price on the demand curve that corresponds to the output rate.

5. For effective price discrimination to occur, the seller must:
    A. face a downward-sloping demand curve.
    B. have a large advertising budget relative to sales.
    C. be able to ensure resale of the product among customers.
    D. know the demand elasticities of all its customers.

6. A monopoly situation in which the ATC of production steadily declines with increased output is called a:
    A. legal monopoly.
    B. natural monopoly.
    C. structural monopoly.
    D. declining cost monopoly.

7. When a regulatory agency requires a monopolist to use average cost pricing, the intent is to price the product where the:
    A. MR curve intersects the variable cost curve.
    B. MR curve intersects the demand curve.
    C. ATC curve intersects the MR curve.
    D. ATC curve intersects the market demand curve.

ANSWERS – CONCEPT CHECKERS: MONOPOLY

1. C A monopolist will expand production until MR = MC, and the price of the product will be determined by the demand curve.

2. C Monopolists must search for the profit maximizing price (and output) because they do not have perfect information regarding demand. Firms under perfect competition take the market price as given and only determine the profit maximizing quantity.

3. B A natural monopoly may exist when economies of scale are great. The large economies of scale make it inefficient to have multiple producers.

4. D A monopolist will maximize profits by producing at the output level where MR equals MC and charging a price on the demand curve that corresponds to the output rate. This will maximize profits. The goal of the monopolist is to maximize profits, not price or revenue.

5. A In order for effective price discrimination to occur, the seller must face a downward-sloping demand curve. The seller must also have at least two identifiable groups of customers with different price elasticities of demand for the product, and the seller must be able to *prevent* customers from reselling the product. Knowing the elasticities of demand for *all* its customers is not necessary.

6. B A monopoly situation in which the ATC of production continually declines with increased output is called a natural monopoly.

7. D When a regulatory agency requires a monopolist to use average cost pricing, the intent is to price the product where the ATC curve intersects the market demand curve. A problem in using this method is actually determining exactly what the ATC is.

MONOPOLISTIC COMPETITION AND OLIGOPOLY

EXAM FOCUS

Make sure you know the characteristics of both of these types of markets. For monopolistic competition, know the importance of advertising, product differentiation, and product innovation and arguments about the economic efficiency of these activities. Be able to explain how firms in monopolistic competition earn economic profits in the short run, and how output and price are determined in the long run. Understand the incentives of oligopolists to collude and how the Prisoners' Dilemma relates to oligopoly output decisions when two firms enter into a price-fixing agreement.

LOS 20.a: Discuss the characteristics of monopolistic competition, economic profit and loss in the short-run, output and price in the long-run, and discuss whether or not monopolistic competition is efficient.

Monopolistic competition has the following market characteristics:

- *A large number of independent sellers:* (1) Each firm has a relatively small market share, so no individual firm has any significant power over price. (2) Firms need only pay attention to average market price, not the price of individual competitors. (3) There are too many firms in the industry for collusion (price fixing) to be possible.
- Each seller produces a *differentiated product*, so every firm has a product that is slightly different from its competitors (at least in the minds of consumers). The competing products are close substitutes for one another.
- *Firms compete on price, quality, and marketing* as a result of product differentiation. *Quality* is a significant product differentiating characteristic. *Price* and output can be set by firms because they face downward sloping demand curves, but there is usually a strong correlation between quality and the price that firms can charge. *Marketing* is a must in order to inform the market about a product's (differentiating) characteristics.
- *Low barriers to entry* so that firms are free to enter and exit the market. If firms in the industry are earning economic profits, new firms can be expected to enter the industry.

Firms in monopolistic competition face *downward-sloping demand* curves (they are price searchers). Their demand curves are highly *elastic* because competing products are perceived by consumers as close substitutes. Think about the market for toothpaste. All toothpaste is quite similar, but differentiation occurs due to taste preferences, influential advertising, and the reputation of the seller. However, if the price of your favorite brand increased significantly, you would be more likely to try other brands, which you would likely not do if the prices of all brands were similar.

The price/output decision for monopolistic competition is illustrated in Figure 1. Panel (a) of Figure 1 illustrates the short-run price/output characteristics of monopolistic competition for a single firm. As indicated, firms in monopolistic competition maximize economic profits by producing where marginal revenue, MR, equals marginal cost, MC, and by charging the price for that quantity from the demand curve, D. Here the firm earns positive economic profits because price, P^*, exceeds average total cost (ATC^*). Due to low barriers to entry, competitors will enter the market in pursuit of these economic profits.

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Panel (b) of Figure 1 illustrates long-run equilibrium for a *representative* firm after new firms have entered the market. As indicated, the entry of new firms shifts the demand curve faced by each individual firm down to the point where price equals average total cost ($P^* = ATC^*$) such that economic profit is zero. At this point, there is no longer an incentive for new firms to enter the market and long-run equilibrium is established. The firm in monopolistic competition continues to produce at the quantity where MR = MC, but no longer earns positive economic profits.

Figure 1: Short-Run and Long-Run Output Under Monopolistic Competition
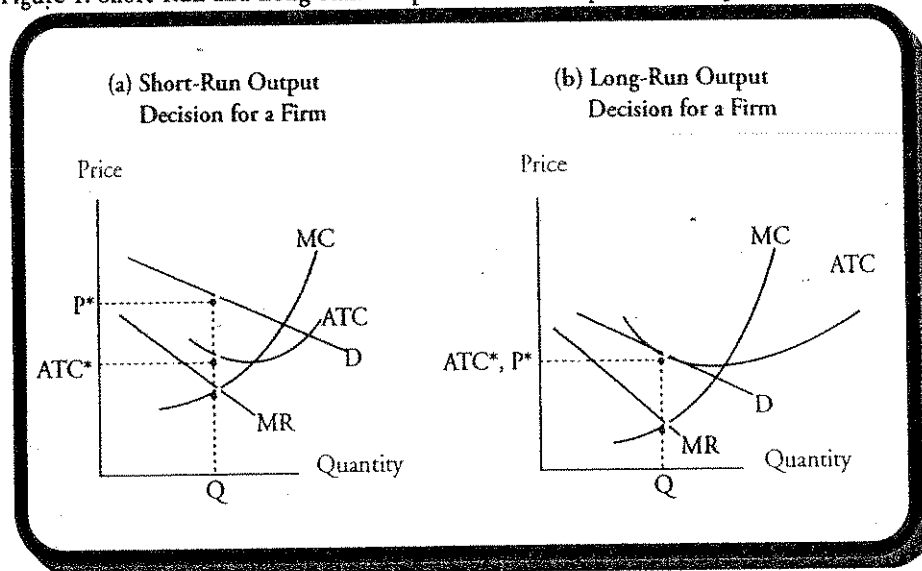

Figure 2 illustrates the differences between long-run equilibrium in markets with monopolistic competition and markets with perfect competition. Note that with monopolistic competition, price is greater than marginal cost (suggesting inefficient allocation of resources), average total cost is not at a minimum for the quantity produced (suggesting inefficient scale of production), and the price is slightly higher than under perfect competition. The point to consider here, however, is that perfect competition is characterized by no product differentiation. The question of the efficiency of monopolistic competition becomes: Is there an economically efficient amount of product differentiation?

In a world with only one brand of toothpaste, clearly average production costs would be lower. That fact alone probably does not mean that a world with only one brand/type of toothpaste would be a better world. While product differentiation has costs, it also has benefits to consumers. As we will see in the next section, additional benefits in terms of greater product innovation and the information about quality that can be conveyed by brand names may also offset the apparent lack of efficiency in markets characterized by monopolistic competition.

Figure 2: Firm Output Under Monopolistic and Perfect Competition
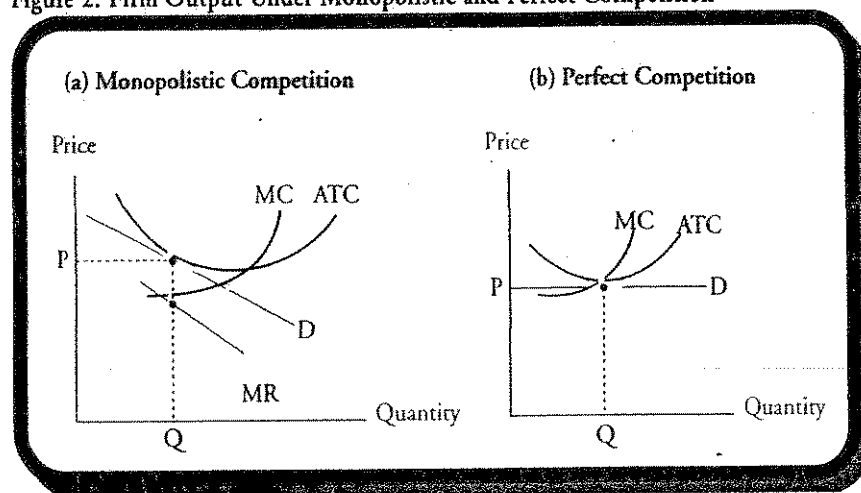
LOS 20.b: **Explain the differences in product development and marketing in monopolistic competition, the impact of advertising costs on the costs curves, and discuss whether or not advertising and branding is efficient in monopolistic competition.**

Product innovation is a necessary activity as firms in monopolistic competition pursue economic profits. Firms that bring new and innovative products to the market are confronted with less-elastic demand curves, enabling them to increase price and earn economic profits. However, close substitutes and imitations will eventually erode the initial economic profit from an innovative product. Thus, firms in monopolistic competition must continually look for innovative product features that will make their products relatively more desirable to some consumers than those of the competition.

Innovation does not come without costs. The costs of product innovation must be weighed against the extra revenue that it produces. A firm is considered to be spending the optimal amount on innovation when the marginal cost of (additional) innovation just equals the marginal revenue (marginal benefit) of additional innovation.

Advertising expenses are high for firms in monopolistic competition. This is not only because firms need to inform consumers about the unique features of their products, but also to create or increase a perception of differences between products that are actually quite similar. We just note here that advertising costs for firms in monopolistic competition are greater than those for firms in perfect competition and those that are monopolies.

As you might expect, advertising costs increase the average total cost curve for a firm in monopolistic competition. The increase to average total cost attributable to advertising decreases as output increases because more fixed advertising dollars are being averaged over a larger quantity. In fact, if advertising leads to enough of an increase in output (sales), it can actually decrease a firm's average total cost.

Brand names provide information to consumers by providing them with signals about the quality of the branded product. Many firms spend a significant portion of their advertising budget on brand name promotion. Seeing the brand name Toyota on an automobile likely tells a consumer more about the quality of a newly introduced automobile than an inspection of the automobile itself would reveal. At the same time, the reputation Toyota has for high quality is so valuable that the firm has an added incentive not to damage it by producing cars and trucks of low quality.

Efficiency of monopolistic competition is unclear. Consumers definitely benefit from brand name promotion and advertising because they receive information about the nature of a product. This often enables consumers to make better purchasing decisions. Convincing consumers that a particular brand of deodorant will actually

increase their confidence in a business meeting or make them more attractive to the opposite sex is not easy or inexpensive. Whether the perception of increased confidence or attractiveness from using a particular product is worth the additional cost of advertising is a question probably better left to consumers of the products. Some would argue that the increased cost of advertising and sales is not justified by the benefits of these activities.

LOS 20.c: Discuss the characteristics of an oligopoly, and the traditional oligopoly models.

Oligopoly is a form of market competition characterized by:

- A small number of sellers.
- Interdependence among competitors (decisions made by one firm affect the demand, price, and profit of others in the industry).
- Significant barriers to entry which often include large economies of scale.
- Products may be similar *or* differentiated.

In contrast to a monopolist, *oligopolists are highly dependent upon the actions of their rivals* when making business decisions. Price determination in the auto industry is a good example. Automakers tend to play "follow the leader" and announce price increases or decreases in close synchronization. They are *not* working explicitly together, but the actions of one producer have a large impact on the others. In addition, the barriers to entry are high in oligopoly markets. The enormous capital investment necessary to start a new auto company or airplane manufacturing firm, because of the large economies of scale in those industries, poses a significant barrier to entry.

One traditional model of oligopoly, the **kinked demand curve model**, is based on the assumption that an increase in a firm's product price will not be followed by its competitors, but a decrease in price will. According to the kinked demand curve model, each firm believes that it faces a demand curve that is more elastic (flatter) above a given price (the kink in the demand curve) than it is below the given price. The kinked demand curve model is illustrated in Figure 3 where the "kink" price is at price P_K where a firm produces Q_K. A firm believes that if it raises its price above P_K its competitors will remain at P_K and it will lose market share because it has the highest price. Above P_K, the demand curve is considered to be relatively elastic, where a small price increase will result in a large decrease in demand. On the other hand, if a firm decreases its price below P_K, other firms will match the price cut, and all firms will experience a relatively small increase in sales.

Figure 3: Kinked Demand Curve Model
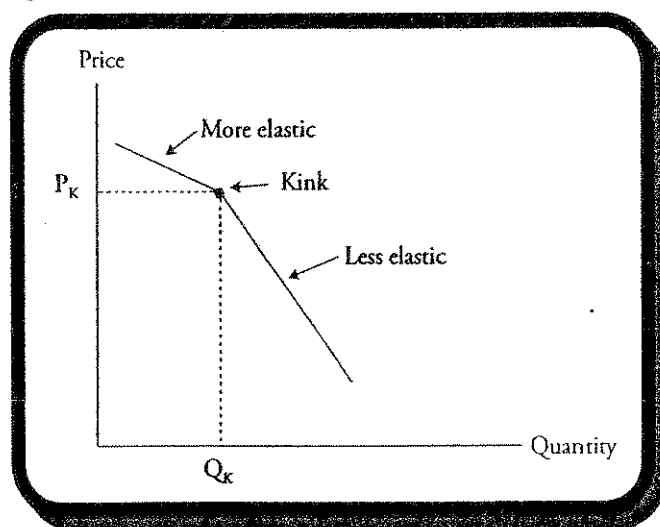
Another traditional oligopoly model, the **dominant firm oligopoly** model, is based on the assumptions that one of the firms in an oligopoly market has a significant cost advantage over its competitors and that this dominant

firm produces a relatively large proportion of the industry's output. Under this model, the dominant firm sets the price in the oligopoly market, and the remaining firms are essentially price takers, with little power to set their own prices.

LOS 20.d: Explain the prisoners' dilemma, how it can be applied to oligopoly price fixing, and the impact on cost, price, demand, and profits.

Game theory is used to examine strategic behavior in an oligopoly. Prisoners' Dilemma is a simple game that may be used to describe the decisions faced by firms competing under oligopoly conditions. Prisoners' Dilemma may be described as follows:

Two suspects, A and B, are believed to have committed a serious crime. However, the prosecutor does not feel that the police have sufficient evidence for a conviction. The prisoners are separated and offered the following deal:

- If Prisoner A confesses and Prisoner B remains silent, Prisoner A goes free and Prisoner B receives a 10-year prison sentence.
- If Prisoner B confesses and Prisoner A remains silent, Prisoner B goes free and Prisoner A receives a 10-year prison sentence.
- If both prisoners remain silent, each will receive a 6-month sentence.
- If both prisoners confess, each will receive a 2-year sentence.

Each prisoner must choose either to betray the other by confessing, or to remain silent. Neither prisoner, however, knows for sure what the other prisoner will choose to do. The result for each of these four possible outcomes is presented in Figure 4.

Figure 4: Prisoners' Dilemma

|	Prisoner B is silent	Prisoner B confesses
Prisoner A is silent	A gets 6 months B gets 6 months	A gets 10 years B goes free
Prisoner A confesses	A goes free B gets 10 years	A gets 2 years B gets 2 years

What should the prisoners do? Well, the *solution to the Prisoners' Dilemma* is to take the best course of action given the action taken by the other prisoner. This means that both prisoners will confess. Why?

Consider Prisoner B's choices. If Prisoner A remains silent, Prisoner B's best option is to confess and go free. If Prisoner A confesses, Prisoner B's best option is to confess and get two years instead of ten. So in either case Prisoner B's best option is to confess. A similar analysis reveals that confessing is Prisoner's A best option as well. The dilemma is that both prisoners know that if they both remain silent, they will only receive a 6-month sentence, but neither has any way of knowing what the other will do.

Oligopoly firms are in a Prisoners' Dilemma type of situation because they can each earn a greater profit if they agree to share a restricted output quantity, but only if neither cheats on the agreement. Oligopolists maximize their total profits by joining together (colluding) and operating as a single seller (monopolist).

Collusion is when firms make an agreement among themselves to avoid various competitive practices, particularly price competition. Figure 5 illustrates a two-firm oligopoly with the potential for collusion.

Figure 5: Cost and Demand for 2-Firm Industry
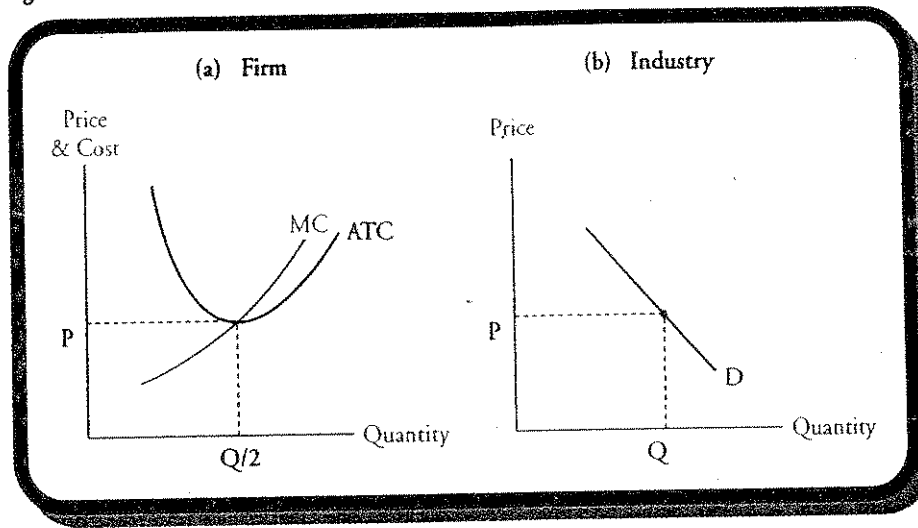
Let's assume that Firm A and Firm B are only two firms in an oligopoly market and they each produce half of the industry's output of an identical product. Figure 5(a) shows that each of these firms produces quantity Q/2 at price P where marginal cost, MC, equals the minimum average total cost, ATC. Figure 5(b) is the industry demand curve, D, where Q is the quantity demanded at price P.

Now, let's assume that Firm A and Firm B have entered into an agreement to reduce output and earn increased profits. As in the Prisoners' Dilemma, these firms have two possible strategies, to honor the agreement or to cheat, so there are four possible outcomes:

- Each firm honors the agreement.
- Both firms cheat.
- Firm A honors the agreement while Firm B cheats.
- Firm B honors the agreement while Firm A cheats.

Let's examine the economic implications of each of these outcomes. Figure 6 illustrates the profit maximizing price and quantity if Firm A and Firm B collude and act jointly as if they were a single monopoly firm.

Figure 6: Price Fixing to Earn Monopoly Profits
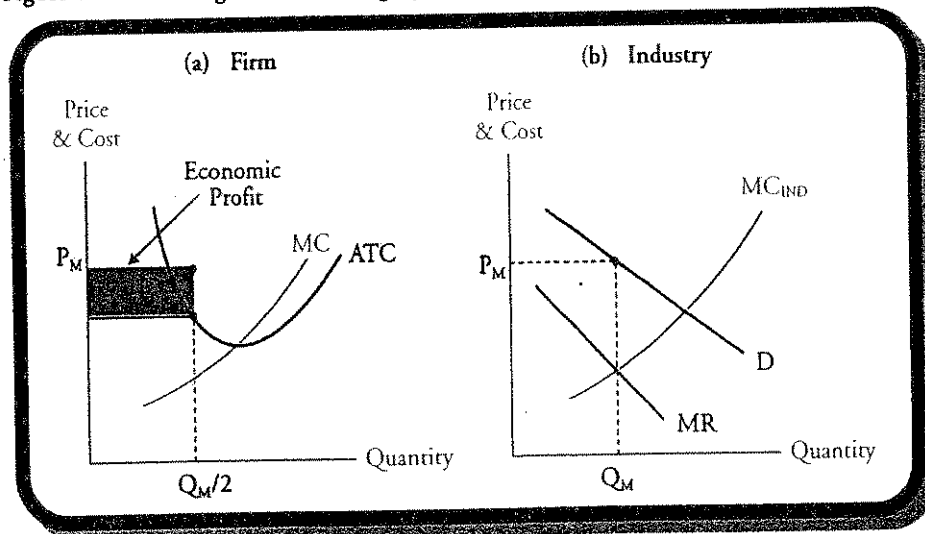
If both firms honor the contract total economic profit will be maximized, and both firms will share it equally. Figure 6(a) shows the marginal cost, MC, and average total cost, ATC, for the each of the firms. Figure 6(b) shows the industry's demand curve, D, marginal cost curve, MC_{IND}, and marginal revenue curve, MR. Note that the industry marginal cost curve, MC_{IND}, is the horizontal sum of the marginal cost curves, MC, for the two firms.

To earn the maximum monopoly profit, the combined output of the two firms must equal the quantity where the marginal revenue for the industry equals the industry's marginal cost. This is quantity Q_M in Figure 6(b). At Q_M, the market price will be P_M. This is the fixed price that the firms will agree to, because at this price, industry demand will be restricted to the monopolistic profit-maximizing quantity Q_M. Assuming that each firm agrees to produce half of the profit maximizing quantity, each firm will produce $Q_M/2$ at price P_M and earn the economic profit indicated in the shaded area in Figure 6(a).

If one firm cheats on the agreement by increasing output above its agreed-upon share, the total economic profit to the industry will be less than that of a monopoly, but the economic profit to the cheating firm will be greater than it would have realized when both firms honored the agreement. On the other hand, the firm that honors the agreement will now be producing the agreed-upon quantity at the same average total cost, but selling at a lower price than expected. This firm may believe that demand has fallen and that the equilibrium price for the agreed-upon total output has fallen. So, the firm that honors the agreement will experience an economic loss. However, the firm that cheated on the agreement by increasing output will realize an increased economic profit by selling more at the lower price, but at a lower average total cost. Total economic profit to the industry will decline.

If both firms cheat by increasing quantity, each firm will increase output to the point where price equals marginal cost and average total cost. The resulting price and output will approach that of a perfectly competitive industry.

Figure 7 below presents the possible outcomes of the collusive agreement between Firm A and Firm B. As in the Prisoners' Dilemma, they will both cheat. Why? Consider the following argument for Firm A.

- *Given that Firm B honors the agreement:* Firm A will earn an economic profit if it honors the agreement, but an even greater economic profit if it cheats. Best Strategy: Firm A should cheat.
- *Given that Firm B cheats:* Firm A will experience an economic loss if it honors the agreement, and zero economic profit if it cheats. Best Strategy: Firm A should cheat.

Therefore, Firm A will cheat. Firm B will cheat as well, based on the same logic.

Figure 7: Prisoners' Dilemma for Two Firms

	Firm B honors	Firm B cheats
Firm A honors	A earns economic profit B earns economic profit	A has an economic loss B earns increased economic profit
Firm A cheats	A earns increased economic profit B has an economic loss	A earns zero economic profit B earns zero economic profit

The probability of successful collusion is greater when cheating is easy to detect, when there are fewer oligopoly firms in a market, when the threat of new entrants to the market is less, and when legal enforcement of anti-collusion laws and penalties for colluding are less.

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KEY CONCEPTS

1. Monopolistic competition is characterized by:
   - A large number of independent sellers.
   - Differentiated products.
   - Firms that compete on price, quality, and marketing.
   - Low barriers to entry.
2. Firms in monopolistic competition maximize economic profits (zero may be the maximum in long-run equilibrium) by producing where MR = MC, and by charging the price from the demand curve.
3. Product innovation and large advertising expenditures are necessary for firms in monopolistic competition and the cost of innovation and advertising activity must be weighed against the benefits that they produce.
4. Oligopoly is a market structure characterized by:
   - A small number of sellers.
   - Interdependence among competitors (decisions made by one firm affect the demand, price, and profit of others in the industry).
   - Significant barriers to entry, which often include large economies of scale.
   - Products that may be similar or differentiated.
5. The kinked demand model of oligopoly is based on an assumption that each firm believes that at some specific price, demand is more elastic for a price increase than for a price decrease.
6. The dominant firm model of oligopoly is based on an assumption that one firm dominates the market and the remaining firms are essentially price takers.
7. Prisoners' Dilemma is a game that illustrates that the best course of action for an oligopoly firm, when engaging in collusion with another oligopoly firm, is to cheat.

CONCEPT CHECKERS: MONOPOLISTIC COMPETITION AND OLIGOPOLY

1. A characteristic of monopolistic competition is:
   A. differentiated products.
   B. inelastic demand curves.
   C. high barriers to entry and exit.
   D. a single seller with no competition.

2. The demand for products from monopolistic competitors is elastic due to:
   A. high barriers to entry.
   B. the availability of many close substitutes.
   C. the availability of many complementary goods.
   D. the allocative inefficiency of monopolistic competition.

3. From the prices and outputs for a firm (shown in the table below), determine how many units the firm should produce to maximize profits.

Output	Price	Total Cost
10	4.00	$40
20	3.60	60
30	3.20	80
40	2.60	95

   A. 10.
   B. 20.
   C. 30.
   D. 40.

4. Which of the following *least accurately* describes a feature that monopolistic competition and perfect competition have in common?
   A. Low or no barriers to entry.
   B. Zero economic profits in the long run.
   C. Output occurs where MR = MC.
   D. Extensive advertising to differentiate products.

5. An oligopolistic industry has:
   A. many sellers.
   B. few barriers to entry.
   C. few economies of scale.
   D. a great deal of interdependence among firms.

6. Consider a firm in an oligopoly market that believes the demand curve for its product is more elastic above a certain price than below this price. This belief fits *most closely* to which of the following models?
   A. Dominant firm model.
   B. Kinked demand model.
   C. Variable elasticity model.
   D. Differentiated demand model.

7. Consider an agreement between France and Germany that will restrict wine production so that maximum economic profit can be realized. The possible outcomes of the agreement are presented in the table below.

	Germany complies	Germany defaults
France complies	France gets €8 billion Germany gets €8 billion	France gets €2 billion Germany gets €10 billion
France defaults	France gets €10 billion Germany gets €2 billion	France gets €4 billion Germany gets €4 billion

Based on the game theory framework, the *most likely* strategy followed by the two countries with respect to whether they comply with or default on the agreement will be:
A. both countries will default.
B. both countries will comply.
C. Germany will default; France will comply.
D. Germany will comply; France will default.

ANSWERS – CONCEPT CHECKERS: MONOPOLISTIC COMPETITION AND OLIGOPOLY

1. A   Differentiated products are a key characteristic of monopolistic competition.

2. B   The demand for products from firms competing in monopolistic competition is elastic due to the availability of many close substitutes. If a firm increases its product price, it will lose customers to firms selling substitute products at lower prices.

3. C   profit = total revenue – total cost = TR – TC = P × Q – TC
    At Q = 10, P × Q – TC = $40 – $40 = $0
    At Q = 20, P × Q – TC = $72 – $60 = $12
    At Q = 30, P × Q – TC = $96 – $80 = $16
    At Q = 40, P × Q – TC = $104 – $95 = $9

    The level of output that provides the greatest profit is 30.

4. D   The only item listed in the question that monopolistic competition and perfect competition do not have in common is the use of advertising to differentiate their products.

5. D   An oligopolistic industry has a great deal of interdependence among firms. One firm's pricing decisions or advertising activities will affect the other firms.

6. B. The kinked demand model assumes that each firm in a market believes that at some price, demand is more elastic for a price increase than for a price decrease.

7. A   The solution for the game is for each nation is to pursue the strategy that is best, given the strategy that is pursued by the other nation.
    •   Given that Germany complies with the agreement: France will get €8 billion if it complies, but €10 billion if it defaults. Therefore France should default.
    •   Given that Germany defaults: France will get €2 billion if it complies, but €4 billion if it defaults. Therefore France should default.
    •   Because France is better off in either case by defaulting, France will default.
    •   Germany will follow the same logic and reach the same conclusion.