DEMAND AND SUPPLY

Introduction

- Supply and demand are the forces that make market economies work.

- They determine the quantity of each good produced and the price at which it is sold. If you want to know how any event or policy will affect the economy, you must think first about how it will affect supply and demand.

- The terms *supply* and *demand* refer to the behavior of people as they interact with one another in competitive markets.

What is a market?

- A **market** is a group of buyers and sellers of a particular good or service. The buyers as a group determine the demand for the product, and the sellers as a group determine the supply of the product.

- Sometimes markets are highly organized, such as the markets for many agricultural commodities. In these markets, buyers and sellers meet at a specific time and place, where an auctioneer helps set prices and arrange sales.

- More often, markets are less organized. For example, consider the market for ice cream in a particular town. Buyers of ice cream do not meet together at any one time. The sellers of ice cream are in different locations and offer somewhat different products. There is no auctioneer calling out the price of ice cream. Each seller posts a price for an ice-cream cone, and each buyer decides how much ice cream to buy at each store.

What is competition?

- Economists use the term **competitive market** to describe a market in which there are so many buyers and so many sellers that each has a negligible impact on the market price. Each seller of ice cream has limited control over the price because other sellers are offering similar products.

- A perfectly competitive market must have two characteristics: (1) the goods offered for sale are all exactly the same, and (2) the buyers and sellers are so numerous that no single buyer or seller has any influence over the market price.

- Because buyers and sellers in perfectly competitive markets must accept the price the market determines, they are said to be *price takers.* At the market price, buyers can buy all they want, and sellers can sell all they want.

- Not all goods and services, however, are sold in perfectly competitive markets. Some markets have only one seller, and this seller sets the price. Such a seller is called a **monopoly**.

- Despite the diversity of market types we find in the world, assuming perfect competition is a useful simplification and, therefore, a natural place to start. Perfectly competitive markets are the easiest to analyze because everyone participating in the market takes the price as given by market conditions. Moreover, because some degree of competition is present in most markets, many of the lessons that we learn by studying supply and demand under perfect competition apply in more complicated markets as well.

Demand

- The **quantity demanded** of any good is the amount of the good that buyers are willing and able to purchase. Many things influence demand but price plays a central role.

- Other things equal, the quantity demanded of a good falls when the price of the good rises. The inverse relationship between price and quantity demanded is true for most goods in the economy that economists call it the **law of demand**.

Market demand curves

- We sum the individual demand curves ==horizontally== to obtain the **market demand curve**. That is, to find the total quantity demanded at any price, we add the individual quantities, which are found on the horizontal axis of the individual demand curves.

- Because we are interested in analyzing how markets function, we work most often with the market demand curve.

- The ==market demand curve shows how the total quantity demanded of a good varies as the price of the good varies,== while all the other factors that affect how much consumers want to buy are held constant.

Demand Curve

Factors shifting the demand curve

- Because the market demand curve holds other things constant, it need not be stable over time. If something happens to alter the quantity demanded at any given price, the demand curve shifts resulting in either increase (shift to the right) or decrease in demand (shift to the left).

❑Income

❑Prices of related goods-When a fall in the price of one good reduces the demand for another good, the two goods are called **substitutes**. When a fall in the price of one good raises the demand for another good, the two goods are called **complements**.

❑**Expectations** Your expectations about the future may affect your demand for a good or service today. For example, if you expect to earn a higher income next month, you may choose to save less now and spend more of your current income buying ice cream. As another example, if you expect the price of ice cream to fall tomorrow, you may be less willing to buy an ice-cream cone at today's price.

❑**Number of Buyers** In addition to the preceding factors, which influence the behavior of individual buyers, market demand depends on the number of these buyers.

❖Shifts vs movement along the demand curve

Supply

- The **quantity supplied** of any good or service is the amount that sellers are willing and able to sell.

- When the price of ice cream is high, selling ice cream is profitable, and so the quantity supplied is large. By contrast, when the price of ice cream is low, the business is less profitable, and so sellers produce less ice cream.

- This relationship between price and quantity supplied is called the **law of supply**: Other things equal, when the price of a good rises, the quantity supplied of the good also rises, and when the price falls, the quantity supplied falls as well.

Market supply curves

- Just as market demand is the sum of the demands of all buyers, **market supply** is the sum of the supplies of all sellers.

- As with demand curves, we sum the individual supply curves **horizontally** to obtain the market supply curve. That is, to find the total quantity supplied at any price, we add the individual quantities, which are found on the horizontal axis of the individual supply curves.

- The supply curve slopes upward because, other things equal, a higher price means a greater quantity supplied.
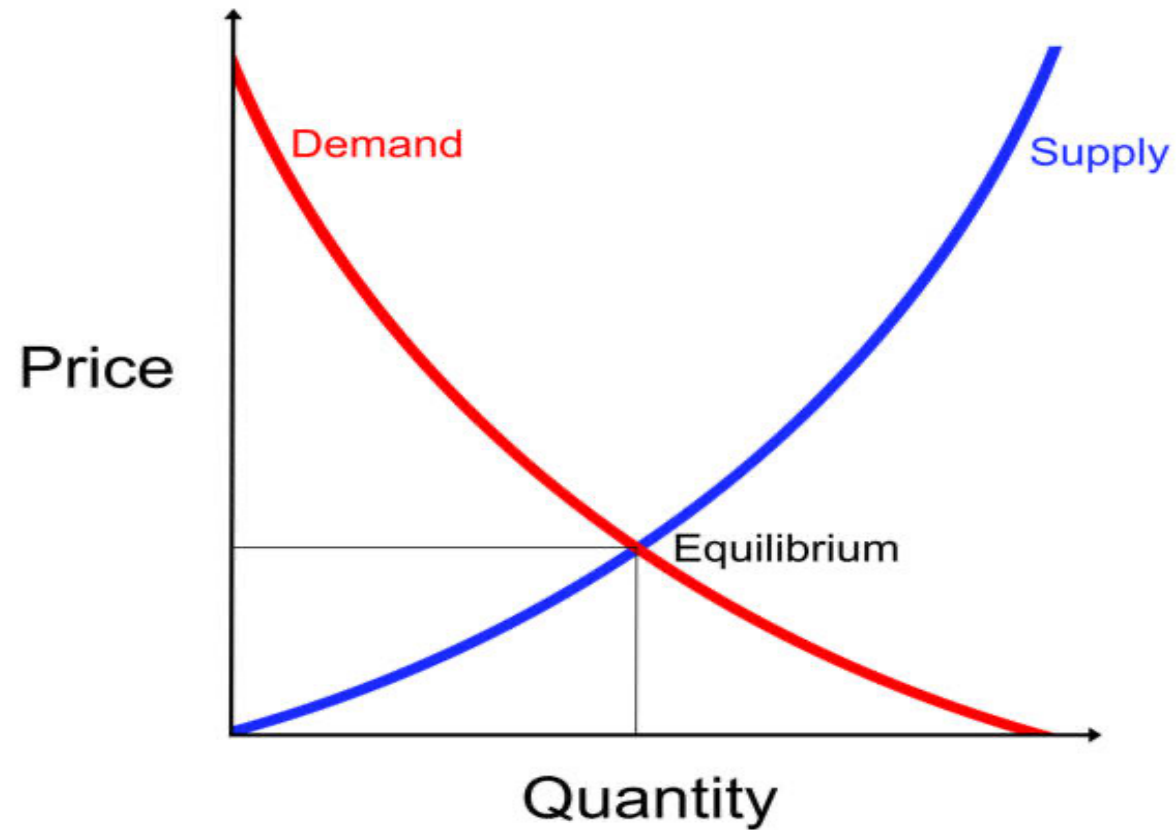
Supply curve

Shifts in the supply curve

- Because the market supply curve holds other things constant, the curve shifts **when one of the factors changes** resulting in either increase (shift to the right) or decrease in supply (shift to the left).

- Input prices
- Technology
- Expectations
- Number of sellers

Demand and Supply

- We now combine market demand and supply curves to see how they determine the price and quantity of a good sold in a market.

- There is one point at which the supply and demand curves intersect. This point is called the market's **equilibrium**. The price at this intersection is called the **equilibrium price**, and the quantity is called the **equilibrium quantity**.

- The equilibrium price is sometimes called the market-clearing price because, at this price, everyone in the market has been satisfied: Buyers have bought all they want to buy, and sellers have sold all they want to sell.

- The actions of buyers and sellers naturally move markets toward the equilibrium of supply and demand. (i.e there is no excess supply or demand)

Equilibrium in the market

Understanding changes to the equilibrium

- Shift of the demand curve (case of increase in demand)

- Shift of the supply curve (case of decrease in supply)

- Simultaneous shifts

Normal and inferior goods

- Normal goods are those goods for which the demand rises as consumer income rises.

- An **inferior good** is a good whose demand decreases when consumer income rises (or demand increases when consumer income decreases)

THANK YOU

ELASTICITY

Price elasticity of demand

- Elasticity is a measure of **how much** buyers and sellers respond to changes in market conditions. When studying how some event or policy affects a market, we can discuss not only the direction of the effects but their magnitude as well.

- The **price elasticity of demand** measures how much the quantity demanded responds to a change in price. Demand for a good is said to be *elastic* if the quantity demanded responds substantially to changes in the price.

- Demand is said to be *inelastic* if the quantity demanded responds only slightly to changes in the price.

Determinants of elasticity of demand

- Elasticity reflects the many economic, social, and psychological forces that shape consumer preferences.

❑**Availability of close substitutes-** Goods with close substitutes tend to have more elastic demand because it is easier for consumers to switch from that good to others.

❑**Necessities vs luxuries-** Necessities tend to have inelastic demands, whereas luxuries have elastic demands. Of course, whether a good is a necessity or a luxury depends not on the intrinsic properties of the good but on the preferences of the buyer.

❑**Definition of the market-** The elasticity of demand in any market depends on how we draw the boundaries of the market. Narrowly defined markets tend to have more elastic demand than broadly defined markets because it is easier to find close substitutes for narrowly defined goods.

❑**Time horizon-** Goods tend to have more elastic demand over longer time horizons.

- The price elasticity of demand as the percentage change in the quantity demanded divided by the percentage change in the price.

Price elasticity of demand = <u>Percentage change in quantity demanded</u>

Percentage change in price

- Reporting in absolute values. A larger price elasticity implies a greater responsiveness of quantity demanded to price.

Midpoint method of computing elasticity

- The standard procedure for computing a percentage change is to divide the change by the initial level. By contrast, the midpoint method computes a percentage change by dividing the change by the midpoint (or average) of the initial and final levels.

- Price elasticity of demand = $\dfrac{(Q2 - Q1) / [(Q2 + Q1) / 2]}{(P2 - P1) / [(P2 + P1) / 2]}$

- Because the midpoint method gives the same answer regardless of the direction of change, it is often used when calculating the price elasticity of demand between two points.

Variety of demand curves

- Economists classify demand curves according to their elasticity. Demand is considered **elastic** when the elasticity is greater than 1, which means the quantity moves proportionately more than the price.

- Perfectly elastic (infinite elasticity)- demand curve horizontal

- Demand is considered **inelastic** when the elasticity is less than 1, which means the quantity moves proportionately less than the price.

- Perfectly inelastic (zero elasticity)- demand curve vertical

- If the elasticity is exactly 1, the quantity moves the same amount proportionately as the price, and demand is said to have *unit elasticity*.

- Because the price elasticity of demand measures how much quantity demanded responds to changes in the price, it is closely related to the slope of the demand curve.

- The flatter the demand curve that passes through a given point, the greater the price elasticity of demand. The steeper the demand curve that passes through a given point, the smaller the price elasticity of demand.

Total revenue and the elasticity of demand

- In any market, total revenue is *P × Q,* the price of the good times the quantity of the good sold.

- **If demand is inelastic,** then an **increase in the price causes an increase in total revenue**. An increase in price from $1 to $3 causes the quantity demanded to fall from 100 to 80, so total revenue rises from $100 to $240. An increase in price raises *P × Q* because the fall in *Q* is proportionately smaller than the rise in *P.*

- **If demand is elastic**, the reduction in the quantity demanded is so great that it more than offsets the increase in the price. This leads to a **decrease in total revenue**.

Income elasticity of demand

- The **income elasticity of demand** measures how the quantity demanded changes as consumer income changes. It is calculated as the percentage change in quantity demanded divided by the percentage change in income.

- Income elasticity of demand =

    Percentage change in quantity demanded

    Percentage change in income

- Most goods are **normal goods**. Higher income raises the quantity demanded. Because quantity demanded and income move in the same direction, normal goods have positive income elasticities.

- Because quantity demanded and income move in opposite directions, inferior goods have negative income elasticities.

- Even among normal goods, income elasticities vary substantially in size. Necessities, such as food and clothing, tend to have small income elasticities because consumers choose to buy some of these goods even when their incomes are low. Luxuries, such as caviar and diamonds, tend to have large income elasticities because consumers feel that they can do without these goods altogether if their incomes are too low.

Cross price elasticity of demand

- The **cross-price elasticity of demand** measures how the quantity demanded of one good responds to a change in the price of another good. It is calculated as the percentage change in quantity demanded of good 1 divided by the percentage change in the price of good 2.

- Cross-price elasticity of demand =

    $$\frac{\text{Percentage change in quantity demanded of good 1}}{\text{Percentage change in the price of good 2}}$$

- Whether the cross-price elasticity is a positive or negative number depends on whether the two goods are substitutes or complements.

Determinants of elasticity of supply

- The **price elasticity of supply** measures how much the quantity supplied responds to changes in the price.

- Supply of a good is said to be *elastic* if the quantity supplied responds substantially to changes in the price. Supply is said to be *inelastic* if the quantity supplied responds only slightly to changes in the price.

- In most markets, a **key determinant of the price elasticity of supply is the time period being considered**. Supply is usually more elastic in the long run than in the short run.

- Over short periods of time, firms cannot easily change the size of their factories to make more or less of a good. Thus, in the short run, the quantity supplied is not very responsive to the price. By contrast, over longer periods, firms can build new factories or close old ones. In addition, new firms can enter a market, and old firms can shut down.

- Economists compute the price elasticity of supply as the percentage change in the quantity supplied divided by the percentage change in the price.

- Price elasticity of supply = $\dfrac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$

Variety of Supply Curves

- In the extreme case of a zero elasticity, supply is *perfectly inelastic,* and the supply curve is vertical. In this case, the quantity supplied is the same regardless of the price.

- As the elasticity rises, the supply curve gets flatter, which shows that the quantity supplied responds more to changes in the price.

- *Perfectly elastic supply* occurs as the price elasticity of supply approaches infinity and the supply curve becomes horizontal, meaning that very small changes in the price lead to very large changes in the quantity supplied.

- **For low levels of quantity supplied**, the **elasticity of supply is high**, indicating that firms respond substantially to changes in the price. In this region, firms have capacity for production that is not being used, such as plants and equipment idle for all or part of the day. Small increases in price make it profitable for firms to begin using this idle capacity.

- As the quantity supplied rises, firms begin to reach capacity. Once capacity is fully used, increasing production further requires the construction of new plants. To induce firms to incur this extra expense, the price must rise substantially, so supply becomes less elastic.

Applications of elasticity

- Innovations in farming- inelastic demand for wheat and supply curve shift

- Drug use- what is the best policy?

➤drug interdiction (shifts the supply curve to the left) or

➤drug education (shifts demand curve to the left)

BUDGET CONSTRAINT

Introduction

- Economists assume that consumers choose the best bundle of goods they can afford. Now, we have to describe more precisely what we mean by "best" and what we mean by "can afford.

- In real life there are many goods to consume, but for our purposes it is convenient to consider only the case of two goods, since we can then depict the consumer's choice behaviour graphically.

- We will indicate the consumer's consumption bundle by (x, y). This is simply a list of two numbers that tells us how much the consumer is choosing to consume of good 1, x, and how much the consumer is choosing to consume of good 2, y.

- We suppose that we can observe the prices of the two goods, (p1, p2) and the amount of money the consumer has to spend, m. Then the budget constraint of the consumer can be written as

p1x + p2y ≤ m.

- The consumer's affordable consumption bundles are those that don't cost any more than m. We call this set of affordable consumption bundles at prices (p1, p2) and income m the budget set of the consumer.

- Two goods are often enough

Budget line

- The budget line is the set of bundles that cost exactly m
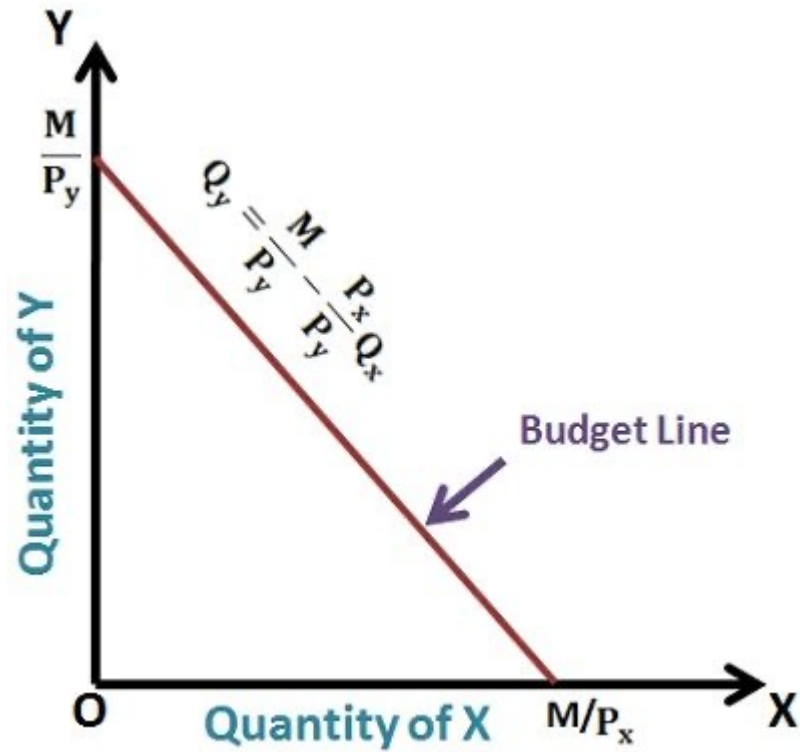
Slope of the budget line

- The slope of the budget line has a nice economic interpretation. It measures the rate at which the market is willing to "substitute" good x for good y.

- The slope of the budget line measures the opportunity cost of consuming good 1. In order to consume more of good x you have to give up some consumption of good y. Giving up the opportunity to consume good y is the true economic cost of more good x consumption; and that cost is measured by the slope of the budget line.

How the budget line changes?

- First consider changes in income. An increase in income will increase the vertical intercept and not affect the slope of the line. Thus an increase in income will result in a parallel shift outward of the budget line.

- Now consider changes in prices. Increasing p1 will not change the vertical intercept, but it will make the budget line steeper since p1/p2 will become larger.

Shifts due to income and price changes
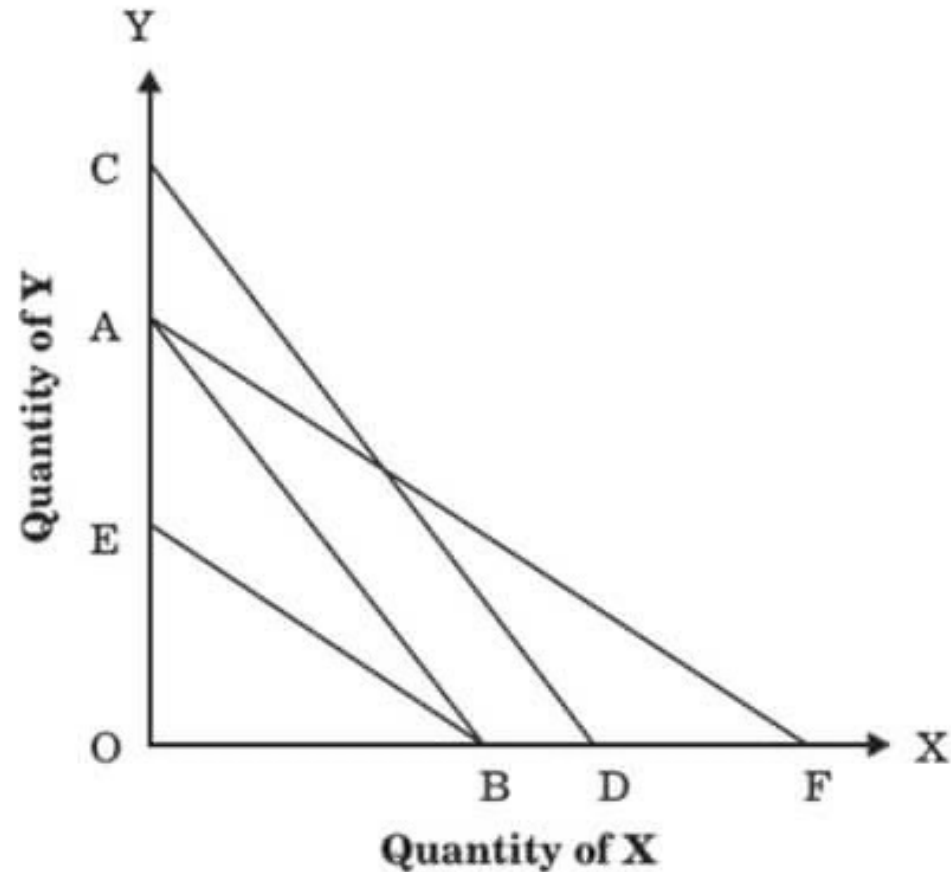
- What happens to the budget line when we change the prices of good 1 and good 2 at the same time? Suppose for example that we double the prices of both goods 1 and 2. In this case both the horizontal and vertical intercepts shift inward by a factor of one-half, and therefore the budget line shifts inward by one-half as well. Multiplying both prices by two is just like dividing income by 2.

What if income decreases and prices increase?

- If m decreases and p1 and p2 both increase, then the intercepts m/p1 and m/p2 must both decrease. This means that the budget line will shift inward.

- What about the slope? If price 2 increases more than price 1, so that −p1/p2 decreases (in absolute value), then the budget line will be flatter; if price 2 increases less than price 1, the budget line will be steeper.

CONSUMER PREFERENCES

Introduction

- In the last session, we devoted to clarifying the meaning of "can afford," and this session will be devoted to clarifying the economic concept of "best things."

- We call the objects of consumer choice consumption bundles.

- We will use the symbol $\succ$ to mean that one bundle is strictly preferred to another, so that $(x_1, x_2) \succ (y_1, y_2)$ should be interpreted as saying that the consumer strictly prefers (x_1, x_2) to (y_1, y_2), in the sense that she definitely wants the x-bundle rather than the y-bundle.

- If the consumer is indifferent between two bundles of goods, we use the symbol $\sim$ and write $(x_1, x_2) \sim (y_1, y_2)$. Indifference means that the consumer would be just as satisfied, according to her own preferences consuming the bundle (x_1, x_2) as she would be consuming the other bundle, (y_1, y_2).

- If the consumer prefers or is indifferent between the two bundles we say that she weakly prefers (x_1, x_2) to (y_1, y_2). This can be written as $(x_1, x_2) \succeq (y_1, y_2)$

Assumptions about Preferences

- We usually make some assumptions about how the preference relations work. Some of the assumptions about preferences are so fundamental that we can refer to them as "axioms" of consumer theory.
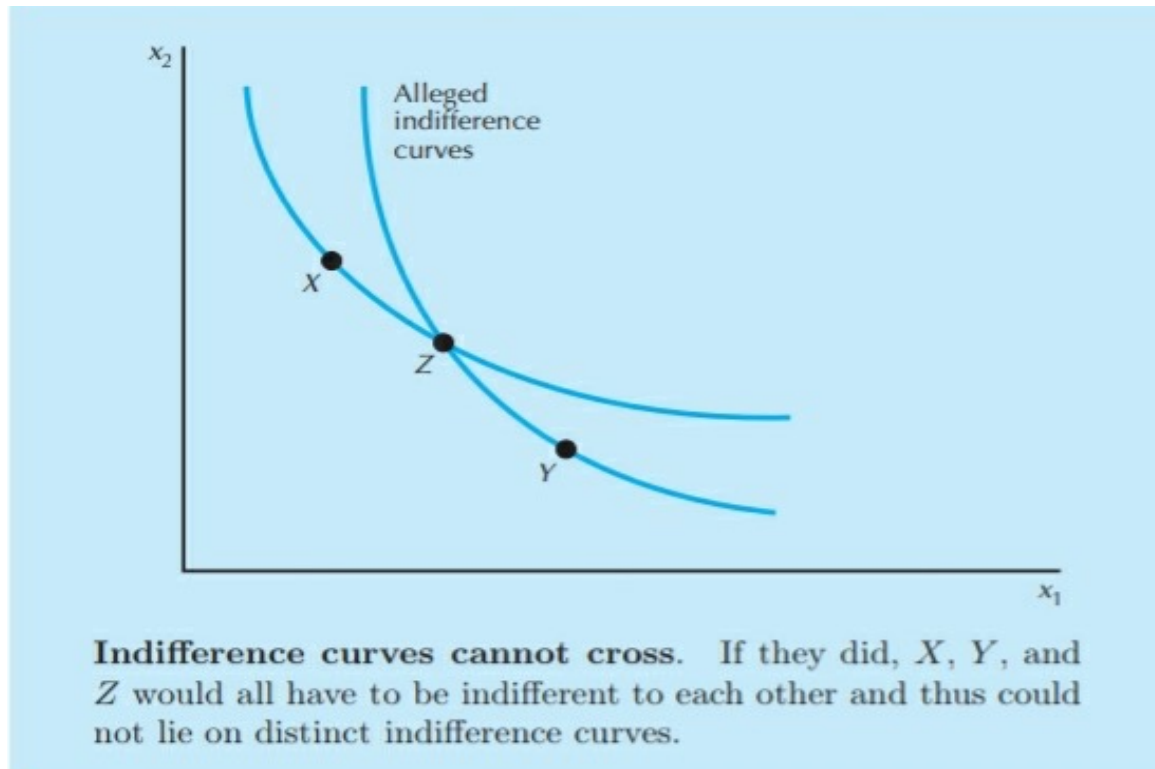
❑ **Three axioms of consumer preference**

- **Complete**. We assume that any two different bundles can be compared. That is, given any x-bundle and any y-bundle, we assume that $(x_1, x_2) \succeq (y_1, y_2)$, or $(y_1, y_2) \succeq (x_1, x_2)$, or both, in which case the consumer is indifferent between the two bundles.

- **Reflexive**- We assume that any bundle is at least as good as itself i.e $(x1, x2) \geq (x1, x2)$.

- **Transitive**- If $(x1, x2) \geq (y1, y2)$ and $(y1, y2) \geq (z1, z2)$, then we assume that $(x1, x2) \geq (z1, z2)$. In other words, if the consumer thinks that X is at least as good as Y and that Y is at least as good as Z, then the consumer thinks that X is at least as good as Z.

Indifference curves

- Preferences can be graphically described using a construction known as indifference curves.

- We can pick a certain consumption bundle (x1, x2) and shade in all of the consumption bundles that are weakly preferred to (x1, x2). This is called the weakly preferred set. The bundles on the boundary of this set—the bundles for which the consumer is just indifferent to (x1, x2)—form the indifference curve.

- We can draw an indifference curve through any consumption bundle we want. The indifference curve through a consumption bundle consists of all bundles of goods that leave the consumer indifferent to the given bundle.

- We can now state an important principle of indifference curves- **indifference curves representing distinct levels of preference cannot cross.**

Indifference curves cannot cross. If they did, X, Y, and Z would all have to be indifferent to each other and thus could not lie on distinct indifference curves.

Examples of preferences

- **Perfect substitutes-** Two goods are perfect substitutes if the consumer is willing to substitute one good for the other at a constant rate. The important fact about perfect substitutes is that the indifference curves have a **constant slope**.
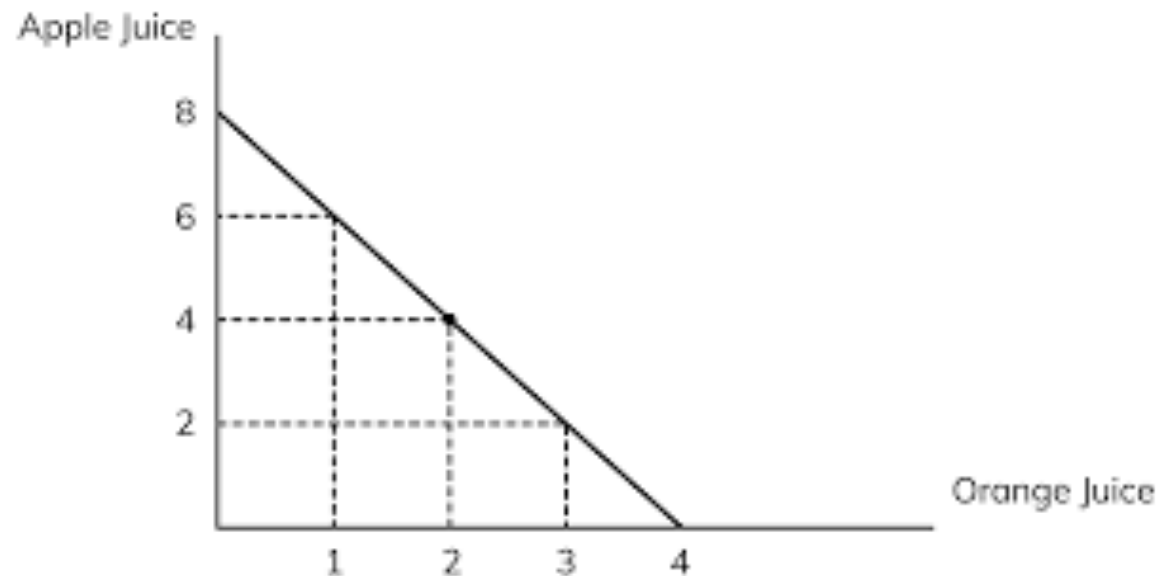
- **Perfect complements**-Perfect complements are goods that are always consumed together in **fixed proportions**. In some sense the goods "complement" each other. A nice example is that of right shoes and left shoes. The consumer likes shoes, but always wears right and left shoes together. **IC's are L- shaped.**
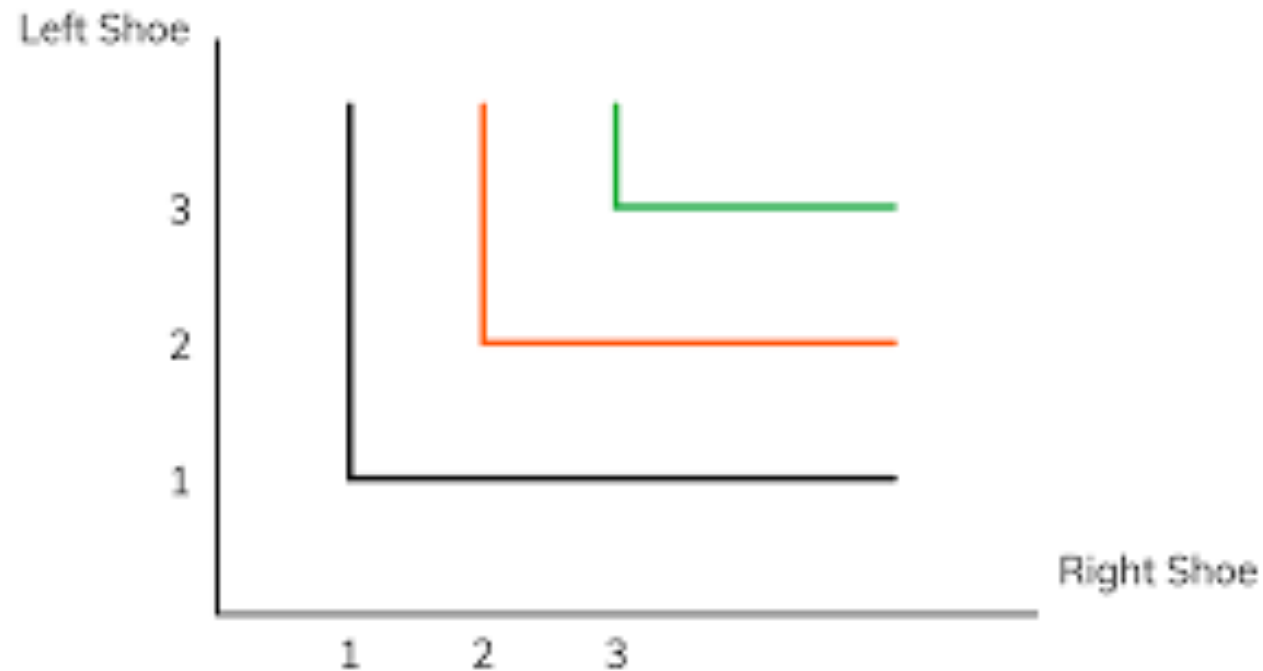
IC in case of 'Bads'

- A bad is a commodity that the consumer doesn't like. Indifference curves in this case slope up and to the right. Consumption preference is towards lesser risk and more average return.
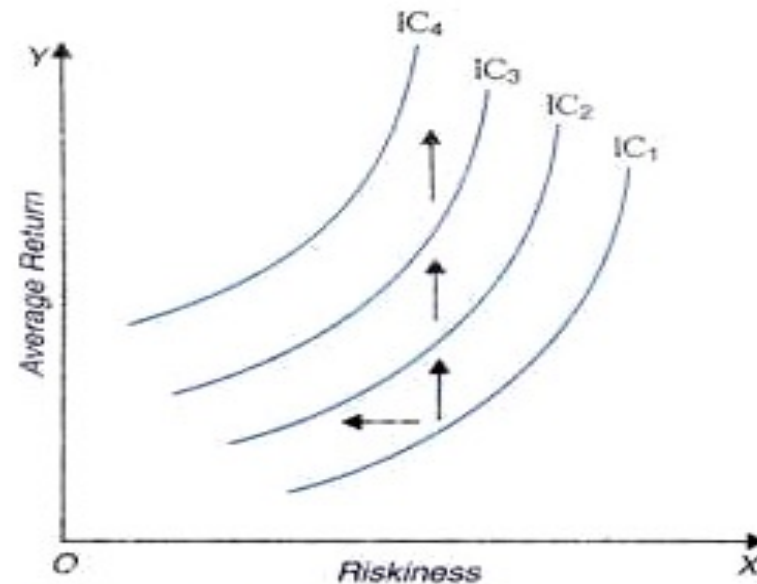
IC in the case of neutral good

- A good is a neutral good if the consumer doesn't care about it one way or the other. In this case, his indifference curves will be vertical lines.
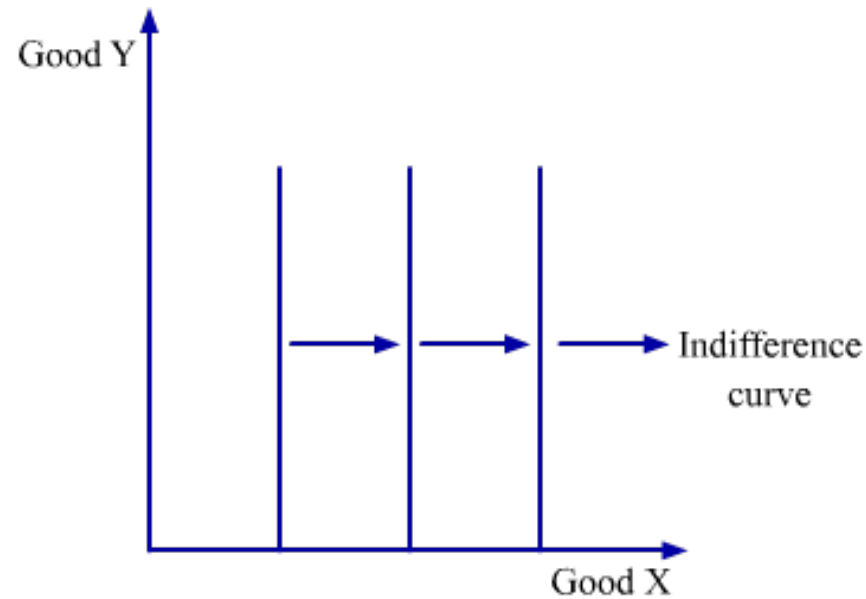
Well behaved preferences

- These are general assumptions that we will typically make about preferences. These assumptions are not the only possible ones; in some situations you might want to use different assumptions. But we will take them as the defining features for **well-behaved indifference curves**.

- ❑First we will typically assume that **more is better**, that is, that we are talking about *goods*, not bads. More precisely, if ($x1, x2$) is a bundle of goods and ($y1, y2$) is a bundle of goods with at least as much of both goods and more of one, then ($y1, y2$) ≻ ($x1, x2$). This assumption is called **monotonicity** of preferences.

- What does monotonicity imply about the shape of indifference curves? It implies that they have a *negative* slope.

❑Second, we are going to assume that averages are preferred to extremes. That is, if we take two bundles of goods (x_1, x_2) and (y_1, y_2) on the same indifference curve and then take an **average bundle, it will be at least as good as or strictly preferred to each of the two extreme bundles**.

- This weighted-average bundle has the average amount of good 1 and the average amount of good 2 that is present in the two bundles. It therefore lies halfway along the straight line connecting the x–bundle and the y–bundle.

- What does this assumption about preferences mean geometrically? It means that **the set of bundles weakly preferred to (x_1, x_2) is a convex set**. For suppose that (y_1, y_2) and (x_1, x_2) are indifferent bundles. Then, if averages are preferred to extremes, all of the weighted averages of (x_1, x_2) and (y_1, y_2) are weakly preferred to (x_1, x_2) and (y_1, y_2). A convex set has the property that if you take *any* two points in the set and draw the line segment connecting those two points, that line segment lies entirely in the set.

Marginal Rate of Substitution

- MRS measures the rate at which the consumer is just willing to substitute one good for the other.

- We've already seen that monotonic preferences imply that indifference curves must have a negative slope. Since the MRS is the numerical measure of the slope of an indifference curve, it will naturally be a negative number.

- Any time the exchange line *crosses* the indifference curve, there will be some points on that line that are preferred to (x_1, x_2)—that lie above the indifference curve. Thus, if there is to be no movement from $x_1, x_2)$, the exchange line must be tangent to the indifference curve. That is, the slope of the exchange line, $-E$, must be the slope of the indifference curve at (x_1, x_2).

- At any other rate of exchange, the exchange line would cut the indifference curve and thus allow the consumer to move to a more preferred point.

- Thus the slope of the indifference curve, the marginal rate of substitution, measures the rate at which the consumer is just on the margin of trading or not trading. At any rate of exchange other than the MRS, the consumer would want to trade one good for the other. But **if the rate of exchange equals the MRS, the consumer wants to stay put**.

Other interpretations of the MRS

- If good 2 represents the consumption of "all other goods," and it is measured in dollars that you can spend on other goods, then **MRS can be interpreted as the marginal willingness- to-pay**. The marginal rate of substitution of good 2 for good 1 is how many dollars you would just be willing to give up spending on other goods in order to consume a little bit more of good 1.

- Thus the MRS measures the marginal willingness to give up dollars in order to consume a small amount more of good 1. But **giving up those dollars is just like paying dollars** in order to consume a little more of good 1.

Marginal Utility and MRS

- Consider a change in the consumption of each good, ($\Delta x1, \Delta x2$), that keeps utility constant—that is, a change in consumption that moves us along the indifference curve. Then we must have

$$MU_1 \Delta x1 + MU_2 \Delta x2 = \Delta U = 0.$$

- Solving for the slope of the indifference curve we have

$$MRS = \frac{\Delta x2}{\Delta x1} = \frac{-MU_1}{MU_2}$$

OPTIMAL CHOICE

Introduction

- We will put together the budget set and the theory of preferences in order to examine the optimal choice of consumers. We said earlier that the economic model of consumer choice is that people choose the best bundle they can afford.

- We can now say that consumers choose the most preferred bundle from their budget sets.

Optimal choice

- Simply start at the right-hand corner of the budget line and move to the left. As we move along the budget line we note that we are moving to higher and higher indifference curves. We stop when we get to the highest indifference curve that just touches the budget line.
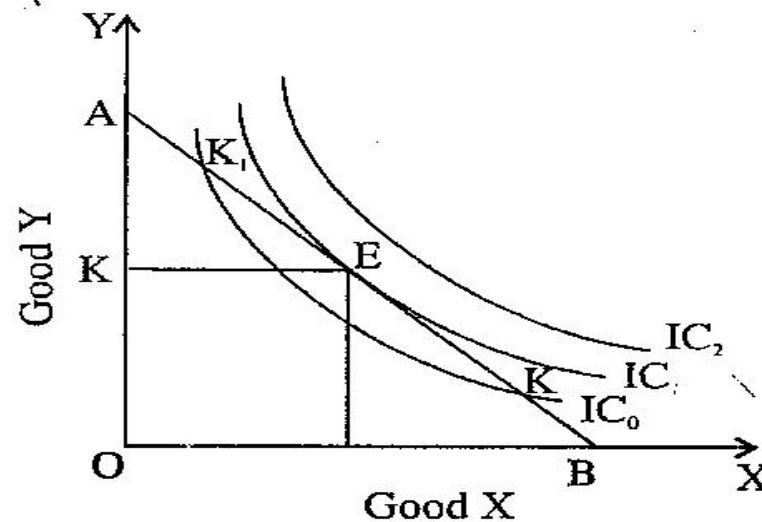
- At this choice, **the indifference curve is *tangent* to the budget line**. If you think about it a moment you'll see that this has to be the case: if the indifference curve weren't tangent, it would cross the budget line, and if it crossed the budget line, there would be some nearby point on the budget line that lies above the indifference curve—which means that we couldn't have started at an optimal bundle.

- Thus, the consumer chooses consumption of the two goods so that the marginal rate of substitution equals the relative price.

- The relative price is the rate at which the *market* is willing to trade one good for the other, whereas the marginal rate of substitution is the rate at which the *consumer* is willing to trade one good for the other. At the consumer's optimum, the consumer's valuation of the two goods (as measured by the marginal rate of substitution) equals the market's valuation (as measured by the relative price).

How changes in income affect consumer choice?

- Suppose that income increases. With higher income, the consumer can afford more of both goods. The increase in income leads to a parallel shift of the budget constraint outward.

- The expanded budget constraint allows the consumer to choose a better combination of both goods (if both goods are normal goods), one that is on a higher indifference curve.

- If a consumer buys less of a good when his income rises, economists call it an **inferior good**.

How changes in prices affect consumer choices?

- The lower price expands the consumer's set of buying opportunities. In other words, a fall in the price of any good shifts the budget constraint outward.

- The decrease in the price of a good makes the consumer better off. If both goods are normal goods, the consumer will want to spread this improvement in his purchasing power over both goods. This **income effect tends to make the consumer buy more of both goods**.

- Yet at the same time, consumption of the particular good has become less expensive relative to consumption of the other good. This **substitution effect tends to make the consumer choose less of the other good** and more of the good whose price has fallen.

Income and Substitution Effects

- Thus, the impact of a change in the price of a good on consumption can be decomposed into two effects: an **income effect** and a **substitution effect**.

- We can interpret the income and substitution effects using indifference curves. The income effect (IE) is the change in consumption that results from the movement to a higher indifference curve. The substitution effect (SE) is the change in consumption that results from being at a point on the same indifference curve with a different marginal rate of substitution.

Hicks' decomposition
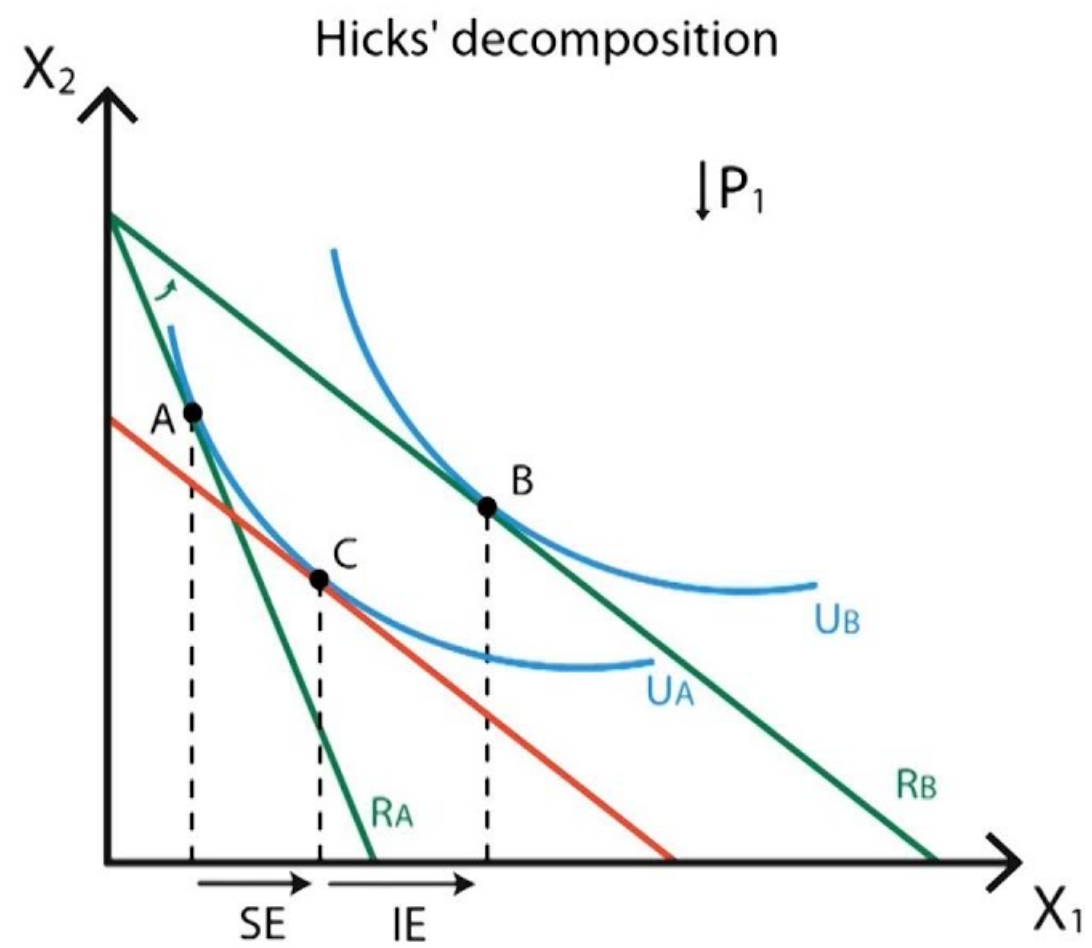
Slutsky Decomposition
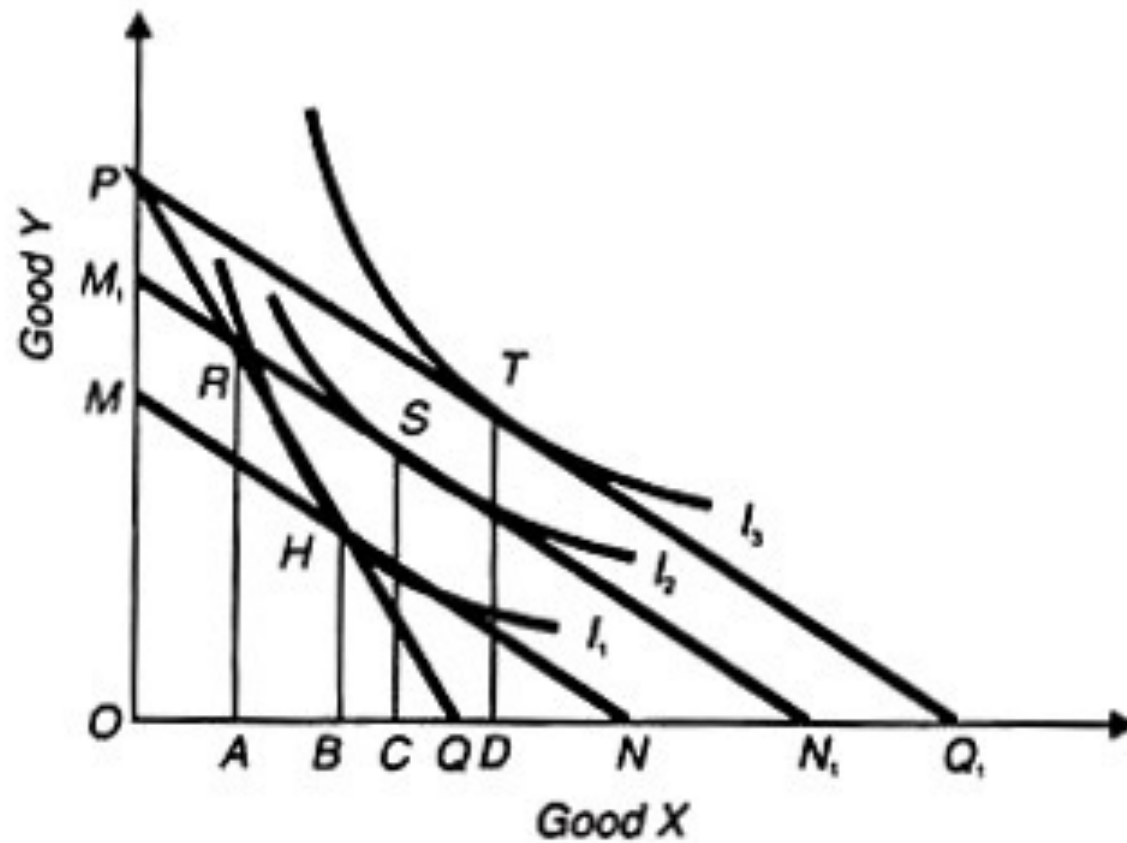
- PQ is the original budget line where R is the point of equilibrium on indifference curve I_1, at which OA of X and RA of Y are bought by the consumer. Now with the fall in the price of X, the budget line extends to PQ_1 and the consumer moves to point T on the higher indifference curve I_3. The movement from R to T is the price effect which shows that the consumer buys AD more of X, as a result of the fall in its price.

- In terms of the Slutsky method, a new budget line $M_1 N_1$ is drawn parallel to PQ_1 in such a way that the apparent real income of the consumer remains the same even after the fall in the price of X. If **$M_1 N_1$ passes through point R, the consumer has the same money income** to buy combination R as he was buying at the old budget line PQ.

- But in reality the consumer prefers the combination S to combination R on the budget line $M_1 N_1$, because point S lies on the budget line which is tangent to a higher indifference curve I_2 than point R which lies on a lower indifference curve I_1. The movement from R to S is the Slutsky substitution effect.

- As a result, the consumer buys AC more of X and the movement from S to T or CD of X is the income effect.

- The **Hicksian substitution effect is smaller than the Slutsky substitution effect** by BC quantity of X. On the other hand, the Hicksian income effect BD is greater than the Slutsky income effect CD.

- The Slutsky theorem is a good approximation to keep real income constant and is superior to Hicks' method. In the Slutsky method, **income can be calculated equal to cost-difference directly by studying market phenomena and behaviour**, whereas the Hicksian compensating variation in income is difficult to estimate.

- The **Slutsky substitution effect provides the consumer greater satisfaction by bringing him on a higher indifference curve**, while the Hicksian substitution effect puts him on the initial level of satisfaction on the original indifference curve.
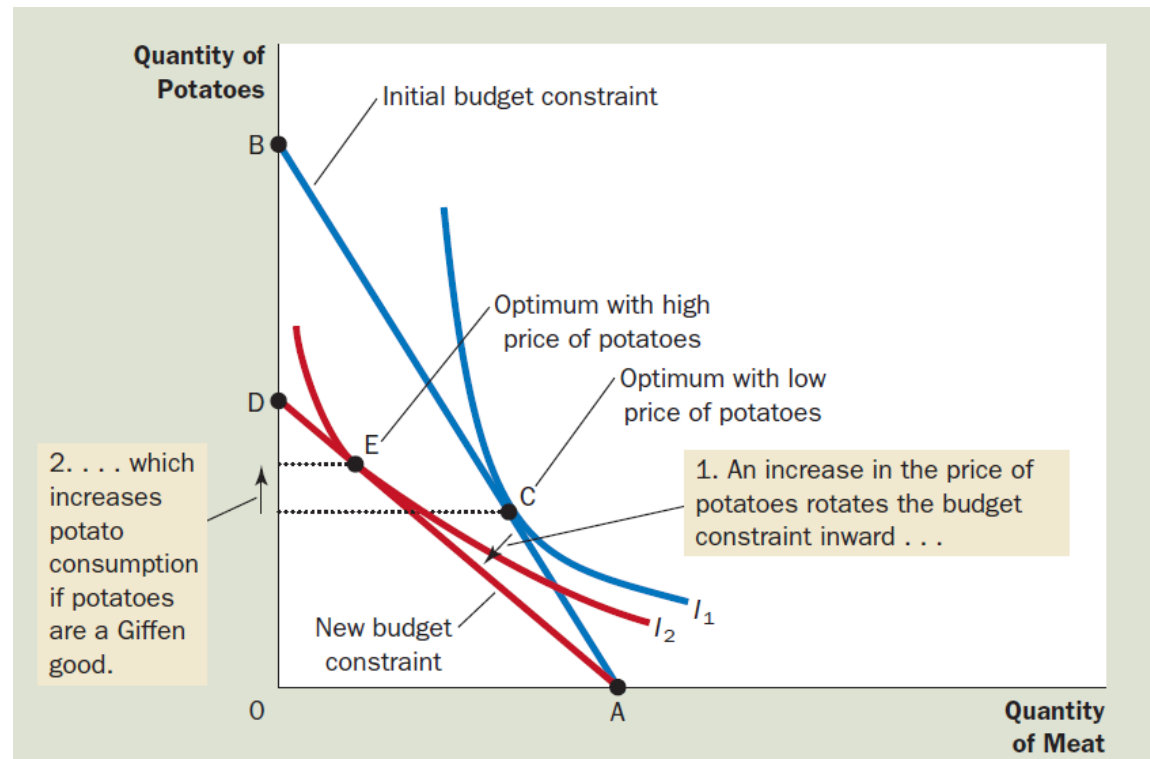
Deriving the demand curve from ICs

- Changes in the price of a good alter the consumer's budget constraint and, therefore, the quantities of the two goods that he chooses to buy. The demand curve for any good reflects these consumption decisions.

- A demand curve shows the quantity demanded of a good for any given price. We can view a consumer's demand curve as a summary of the optimal decisions that arise from his budget constraint and indifference curves.

Price effect in case of inferior goods

- If X is an inferior good, the income effect of a fall in the price of X will be positive because as the real income of the consumer increases, less quantity of X will be demanded. This is so because price and quantity demanded move in the same direction.

- On the other hand, the negative substitution effect will increase the quantity demanded of X. The negative substitution effect is stronger than the positive income effect in the case of inferior goods so that the total price effect is negative.

Price effect in case of Giffen good

- Economists use the term Giffen good to describe a good that violates the law of demand. **Giffen goods are inferior goods for which income effect dominates the substitution effect**. Therefore they have demand curves that slope upward.

Quantity of Potatoes

Initial budget constraint

B

Optimum with high price of potatoes

Optimum with low price of potatoes

D

E

2. . . . which increases potato consumption if potatoes are a Giffen good.

C

1. An increase in the price of potatoes rotates the budget constraint inward . . .

New budget constraint

I_2

I_1

0

A

Quantity of Meat

- When the price of potatoes rises, the consumer is poorer. The income effect makes the consumer want to buy less meat and more potatoes. At the same time, because the potatoes have become more expensive relative to meat, the substitution effect makes the consumer want to buy more meat and less potatoes. However, the income effect is so strong that it exceeds the substitution effect. In the end, the consumer responds to the higher price of potatoes by buying less meat and more potatoes.

- Some historians suggest that potatoes were a Giffen good during the Irish potato famine of the 19th century. Potatoes were such a large part of people's diet that when the price of potatoes rose, it had a large income effect. People responded to their reduced living standard by cutting back on the luxury of meat and buying more of the staple food of potatoes.

Costs of Production

Introduction

- We used the supply curve to summarize firms' production decisions. According to the law of supply, firms are willing to produce and sell a greater quantity of a good when the price of the good is higher, and this response leads to a supply curve that slopes upward. Now we examine firm behavior in more detail which will give you a better understanding of the decisions behind the supply curve.

- It will also introduce you to a part of economics called *industrial organization*—the study of how firms' decisions about prices and quantities depend on the market conditions they face.

Total revenue and profit

- Economists normally assume that the goal of a firm is to maximize profit.

- The amount that the firm receives for the sale of its output is called its **total revenue**. The amount that the firm pays to buy inputs is called its **total cost**. Profit is a firm's total revenue minus its total cost:

Profit = Total revenue – Total cost

Costs as opportunity costs

- When economists speak of a firm's cost of production, **they include all the opportunity costs** of making its output of goods and services. The opportunity cost of an item refers to all those things that must be forgone to acquire that item.

- The costs of inputs, wages etc require the firm to pay out some money. Hence they are called as explicit costs. By contrast, some of a firm's opportunity costs, called **implicit costs**, do not require a cash outlay. Imagine if a proprietor of a firm could have made certain income by working elsewhere. This foregone income would be part of his implicit costs. Both are part of the firms total costs.

- The distinction between explicit and implicit costs highlights an important difference between how economists and accountants analyze a business. Economists are interested in studying how firms make production and pricing decisions. Because these decisions are based on both explicit and implicit costs, **economists include both when measuring a firm's costs**.

- By contrast, accountants have the job of keeping track of the money that flows into and out of firms. As a result, they measure the explicit costs but usually ignore the implicit costs.

Economic profit vs accounting profit

- Because economists and accountants measure costs differently, they also measure profit differently. An economist measures a firm's **economic profit** as the firm's total revenue minus all the opportunity costs (explicit and implicit) of producing the goods and services sold.

- An accountant measures the firm's **accounting profit** as the firm's total revenue minus only the firm's explicit costs.

- Because the accountant ignores the implicit costs, **accounting profit is usually larger than economic profit**. For a business to be profitable from an economist's standpoint, total revenue must cover all the opportunity costs, both explicit and implicit.

- A firm making positive economic profit will stay in business. It is covering all its opportunity costs and has some revenue left to reward the firm owners. When a firm is making economic losses (that is, when economic profits are negative), the business owners are failing to earn enough revenue to cover all the costs of production. Unless conditions change, the firm owners will eventually close down the business and exit the industry.

The Production Function

- The relationship between the quantity of inputs and quantity of output is called the **production function**.

Number of Workers	Output (quantity of cookies produced per hour)	Marginal Product of Labor	Cost of Factory	Cost of Workers	Total Cost of Inputs (cost of factory + cost of workers)
0	0		$30	$0	$30
		50			
1	50		30	10	40
		40			
2	90		30	20	50
		30			
3	120		30	30	60
		20			
4	140		30	40	70
		10			
5	150		30	50	80
		5			
6	155		30	60	90

- The production function shows the relationship between the number of workers hired and the quantity of output produced. The production function gets flatter as the number of workers increases, which reflects diminishing marginal product.
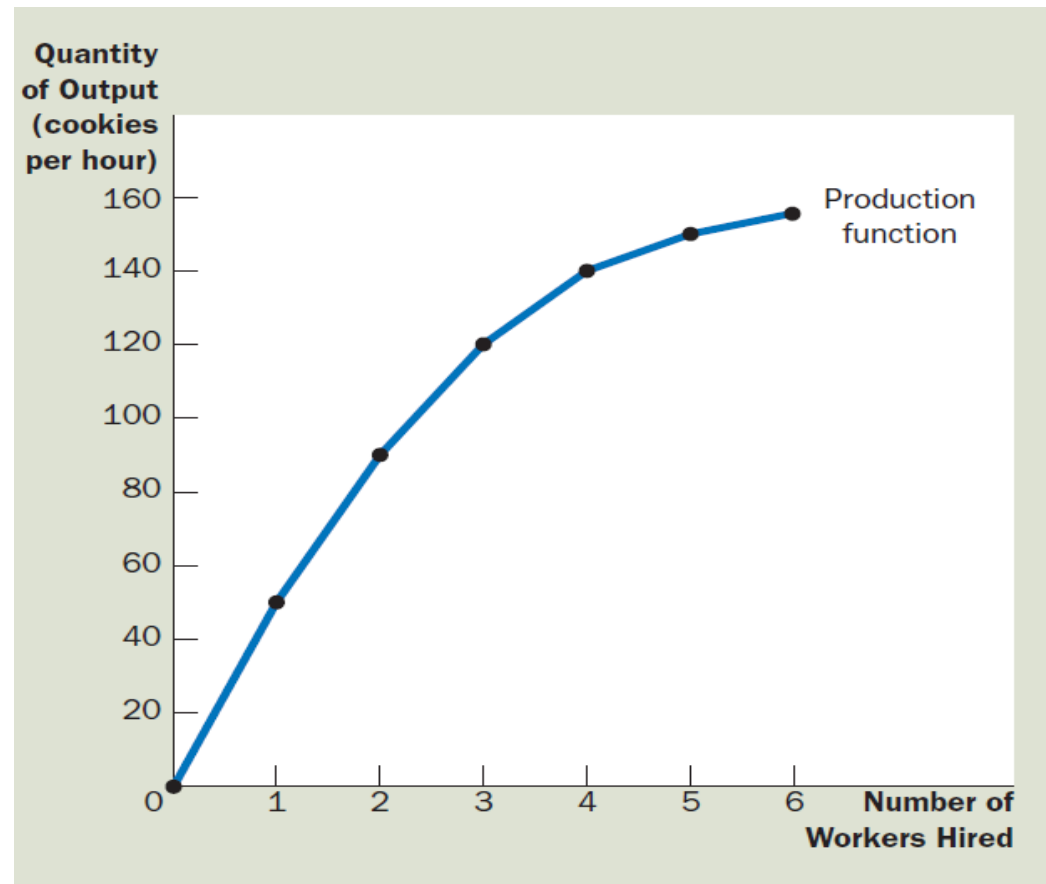
Total cost curve

- The total cost curve shows the relationship between quantity of output produced and the total cost of production. The total cost curve gets steeper as the quantity of output increases because of diminishing marginal product.
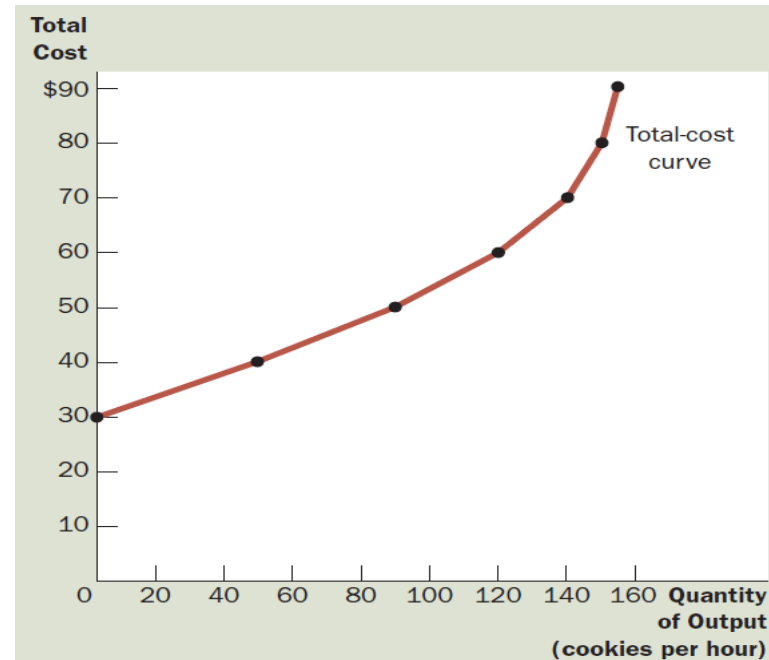
The Various Measures of Cost

- Some costs, called **fixed costs,** do not vary with the quantity of output produced. They are incurred even if the firm produces nothing at all. For instance, the rent for a factory.

- Some of the firm's costs, called **variable costs**, change as the firm alters the quantity of output produced. A firm's total cost is the sum of fixed and variable costs.

- Total cost divided by the quantity of output is called **average total cost**. Because total cost is the sum of fixed and variable costs, average total cost can be expressed as the sum of average fixed cost and average variable cost. **Average fixed cost** is the fixed cost divided by the quantity of output, and **average variable cost** is the variable cost divided by the quantity of output.

- The amount that total cost rises when the firm increases production by 1 unit of output is called the **marginal cost.**

- Average total cost tells us the cost of a typical unit of output if total cost is divided evenly over all the units produced. Marginal cost tells us the increase in total cost that arises from producing an additional unit of output.

Quantity of Coffee (cups per hour)	Total Cost	Fixed Cost	Variable Cost	Average Fixed Cost	Average Variable Cost	Average Total Cost	Marginal Cost
0	$ 3.00	$3.00	$ 0.00	—	—	—	
							$0.30
1	3.30	3.00	0.30	$3.00	$0.30	$3.30	
							0.50
2	3.80	3.00	0.80	1.50	0.40	1.90	
							0.70
3	4.50	3.00	1.50	1.00	0.50	1.50	
							0.90
4	5.40	3.00	2.40	0.75	0.60	1.35	
							1.10
5	6.50	3.00	3.50	0.60	0.70	1.30	
							1.30
6	7.80	3.00	4.80	0.50	0.80	1.30	
							1.50
7	9.30	3.00	6.30	0.43	0.90	1.33	
							1.70
8	11.00	3.00	8.00	0.38	1.00	1.38	
							1.90
9	12.90	3.00	9.90	0.33	1.10	1.43	
							2.10
10	15.00	3.00	12.00	0.30	1.20	1.50	

Cost curves and their shapes

- Many firms experience increasing marginal product before diminishing marginal product. Therefore **marginal cost and average variable cost fall for a while before beginning to rise**. At low levels of output, idle resources mean that marginal product of extra labour is large and marginal cost low. At higher levels, this is reversed.

- Average total cost is the sum of average fixed cost and average variable cost. Average fixed cost always declines as output rises because the fixed cost is spread over a larger number of units.

- When the firm produces large quantity of output, however, the increase in average variable cost becomes the dominant force, and average total cost starts rising. The tug of war between average fixed cost and average variable cost generates the U-shape in average total cost.

- The bottom of the U-shape occurs at the quantity that minimizes average total cost. This quantity is sometimes called the **efficient scale** of the firm.
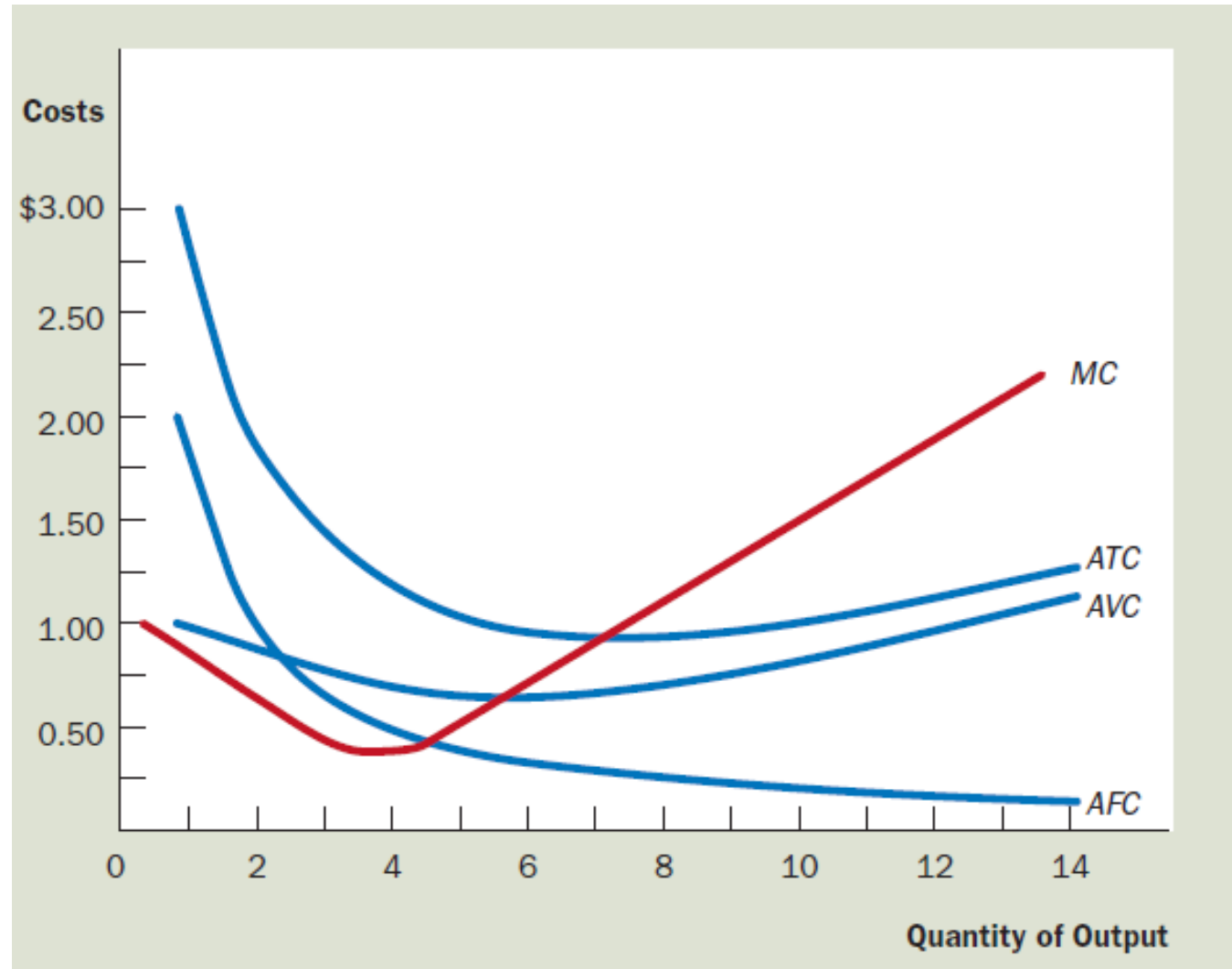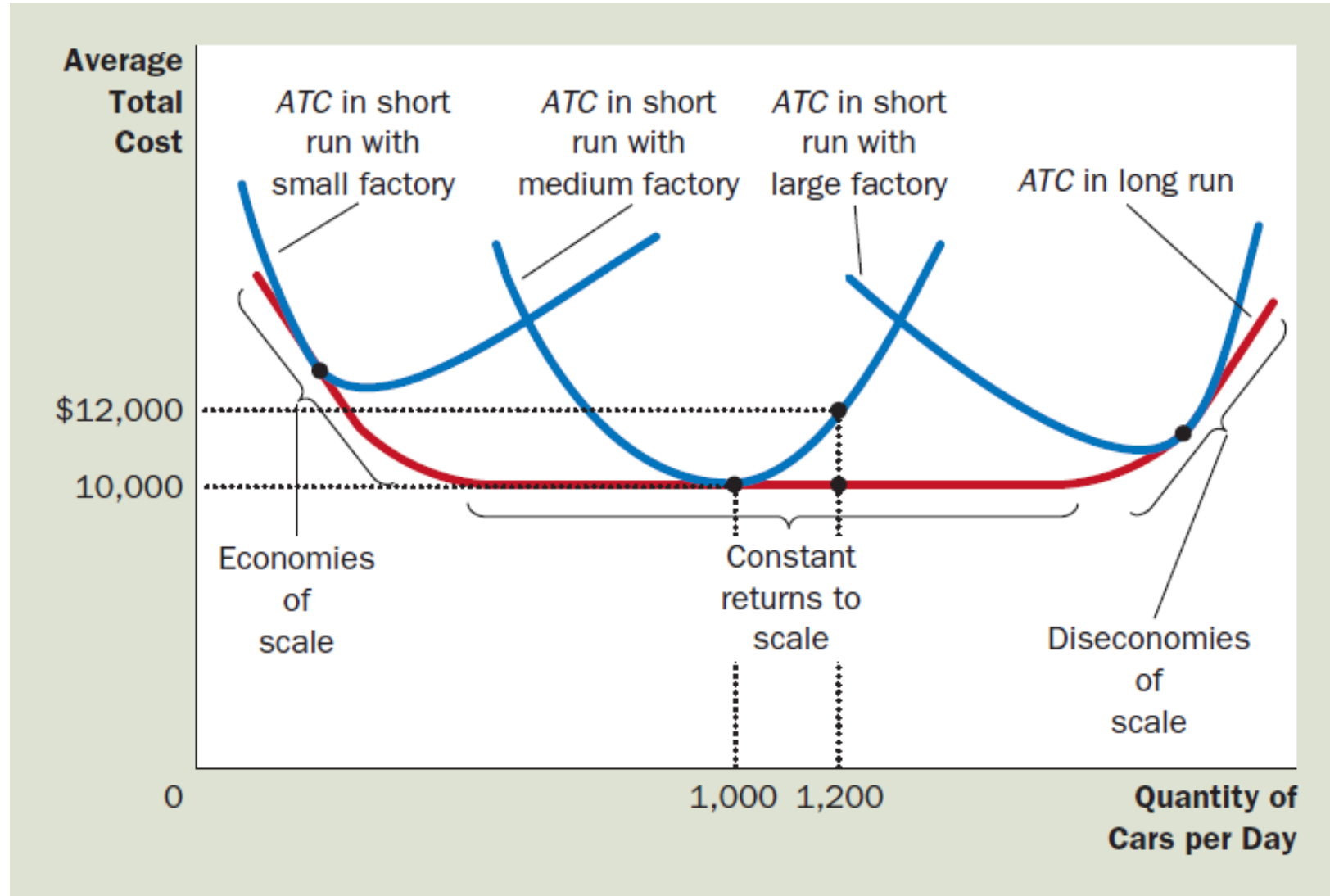
Relationship between Marginal cost and Average Total Cost

- Whenever marginal cost is less than average total cost, average total cost is falling. Whenever marginal cost is greater than average total cost, average total cost is rising.

- This relationship between average total cost and marginal cost has an important corollary: **The marginal-cost curve crosses the average-total-cost curve at its minimum**.

- At low levels of output, marginal cost is below average total cost, so average total cost is falling. But after the two curves cross, marginal cost rises above average total cost which must start to rise at this level of output. Hence, this point of intersection is the minimum of average total cost.

Short run and Long run Average Costs

- Because **many decisions are fixed in the short run** but variable in the long run, a firm's long-run cost curves differ from its short-run cost curves.

- As the firm moves along the long-run curve, it is adjusting the size of the factory to the quantity of production.

- The long-run average-total cost curve is a much flatter U-shape than the short-run average total cost curve. In addition, all the short-run curves lie on or above the long-run. These properties arise because firms have greater flexibility in the long run.

- In essence, in the long run, the firm gets to choose which short-run curve it wants to use. But in the short run, it has to use whatever short-run curve it has chosen in the past.

Average Total Cost

ATC in short run with small factory

ATC in short run with medium factory

ATC in short run with large factory

ATC in long run

$12,000

10,000

Economies of scale

Constant returns to scale

Diseconomies of scale

0

1,000 1,200

Quantity of Cars per Day

Economies and Diseconomies of Scale

- The shape of the long-run average-total-cost curve conveys important information about the production processes that a firm has available for manufacturing a good. In particular, it tells us how costs vary with the scale—that is, the size—of a firm's operations.

- When long-run average total cost declines as output increases, there are said to be **economies of scale**. When long-run average total cost rises as output increases, there are said to be **diseconomies of scale**. When long-run average total cost does not vary with the level of output, there are said to be **constant returns to scale**.

- Economies of scale often arise because **higher production levels allow specialization** among workers, which permits each worker to become better at a specific task. For instance, if Ford hires a large number of workers and produces a large number of cars, it can reduce costs with modern assembly-line production.

- Diseconomies of scale can arise because of **coordination problems** that are inherent in any large organization. The more cars Ford produces, the more stretched the management team becomes, and the less effective the managers become at keeping costs down.

- Thus, long-run average total cost is falling at low levels of production because of increasing specialization and rising at high levels of production because of increasing coordination problems.

Competitive Markets

Introduction

- Difference in market structure shapes the pricing and production decisions of the firms that operate in these markets.

- A market is competitive if each buyer and seller is small compared to the size of the market and, therefore, has little ability to influence market prices. By contrast, if a firm can influence the market price of the good it sells, it is said to have *market power.*

- A market supply curve is tightly linked to firms' costs of production.

Meaning of competition

- **A competitive market**, sometimes called a *perfectly competitive market*, has two characteristics:

▪ There are many buyers and many sellers in the market.

▪ The goods offered by the various sellers are largely the same.

▪ Firms can freely enter or exit the market.

- As a result of first two characteristics, the actions of any single buyer or seller in the market have a negligible impact on the market price. Each buyer and seller takes the market price as given (**price takers**)

Revenue of a Competitive Firm

- Total revenue is proportional to the amount of output since prices are given.

- Average revenue is total revenue ($P \times Q$) divided by the quantity (Q). Therefore, **for all firms, average revenue equals the price of the good.**

- Total revenue is $P \times Q$, and P is fixed for a competitive firm. Therefore, when Q rises by 1 unit, total revenue rises by P rupees. **For competitive firms, marginal revenue equals the price of the good.**

Profit maximization

- The goal of a competitive firm is to maximize profit.
- If marginal revenue is greater than marginal cost—production should be increased because it will put more money in their pockets than it takes out. If it is lesser, production should be decreased as costs saved would exceed the additional revenue lost .
- The firm is at its profit maximizing quantity when marginal revenue equals marginal cost.
- The price line facing the firm is horizontal since it is a price taker. The price of the firm's output is the same regardless of the quantity it decides to produce.

Profit maximizing output

The firm maximizes profit by producing the quantity at which marginal cost equals marginal revenue.
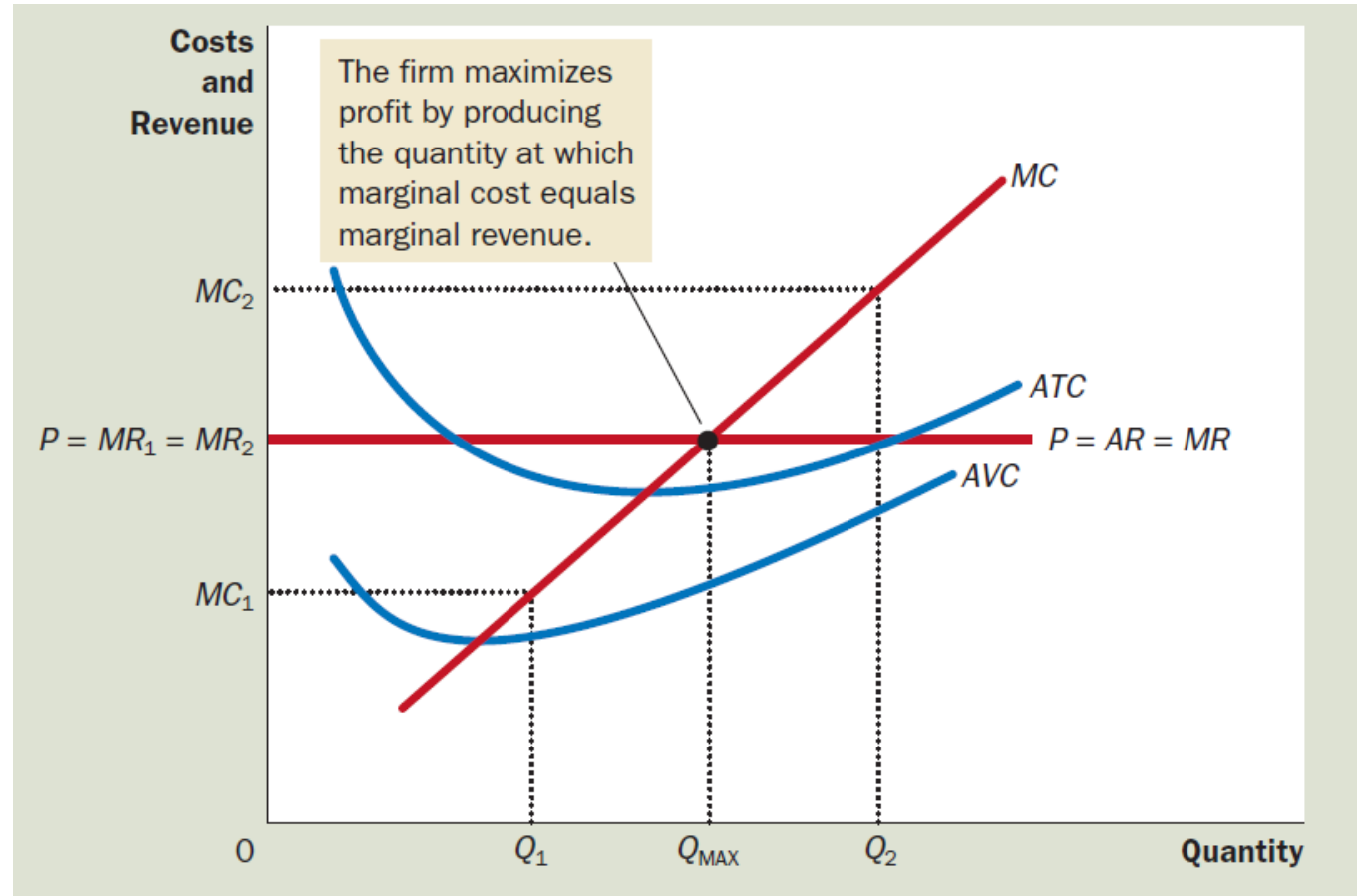
- An increase in the price from P1 to P2 leads to an increase in the firm's profit maximizing quantity from Q1 to Q2. Because the **marginal cost curve** shows the quantity supplied by the firm at any given price, it **is also the competitive firm's supply curve**.
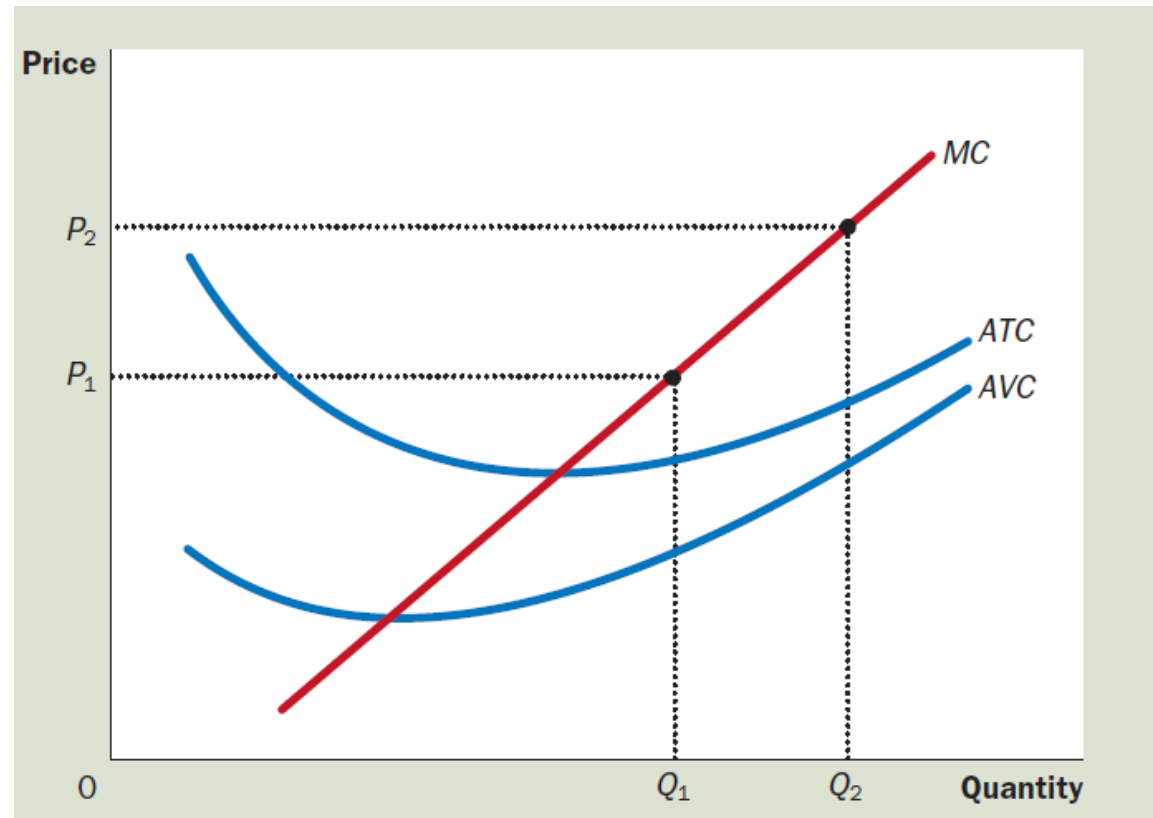
Shutdown in the short run

- In certain circumstances, however, the firm will decide to shut down and not produce anything at all. Here we should distinguish between a temporary shutdown of a firm and the permanent exit of a firm from the market.

- A **shutdown refers to a short-run decision** not to produce anything during a specific period of time because of current market conditions. **Exit** refers to a long-run decision to leave the market.

- The short-run and long-run decisions differ because **most firms cannot avoid their fixed costs in the short run but can do so in the long run**. That is, a firm that shuts down temporarily still has to pay its fixed costs, whereas a firm that exits the market does not have to pay any costs at all, fixed or variable.

- If a farmer decides not to produce any crops one season, the land lies fallow, and he cannot recover this cost. When making the short-run decision whether to shut down for a season, the fixed cost of land is said to be a *sunk cost*. By contrast, if the farmer decides to leave farming altogether, he can sell the land. When making the long-run decision whether to exit the market, the cost of land is not sunk.

- If the firm shuts down, it loses all revenue from the sale of its product. At the same time, it saves the variable costs of making its product (but must still pay the fixed costs).
- Thus, **the firm shuts down if the revenue that it would get from producing is less than its variable costs of production.**

- The firm shuts down if total revenue is less than variable cost. By dividing both sides of this inequality by the quantity Q, we get

Shut down if *P < AVC*

- That is, a firm chooses to shut down if the price of the good is less than the average variable cost of production. When choosing to produce, the firm compares the price it receives for the typical unit to the average variable cost that it must incur to produce the typical unit. If the price doesn't cover the average variable cost, the firm is better off stopping production altogether.

- The firm will be losing money (since it still has to pay fixed costs), but it would lose even more money staying open. The firm can reopen in the future if conditions change so that price exceeds average variable cost.

- The competitive firm's short-run supply curve is the portion of its marginal-cost curve that lies above average variable cost.
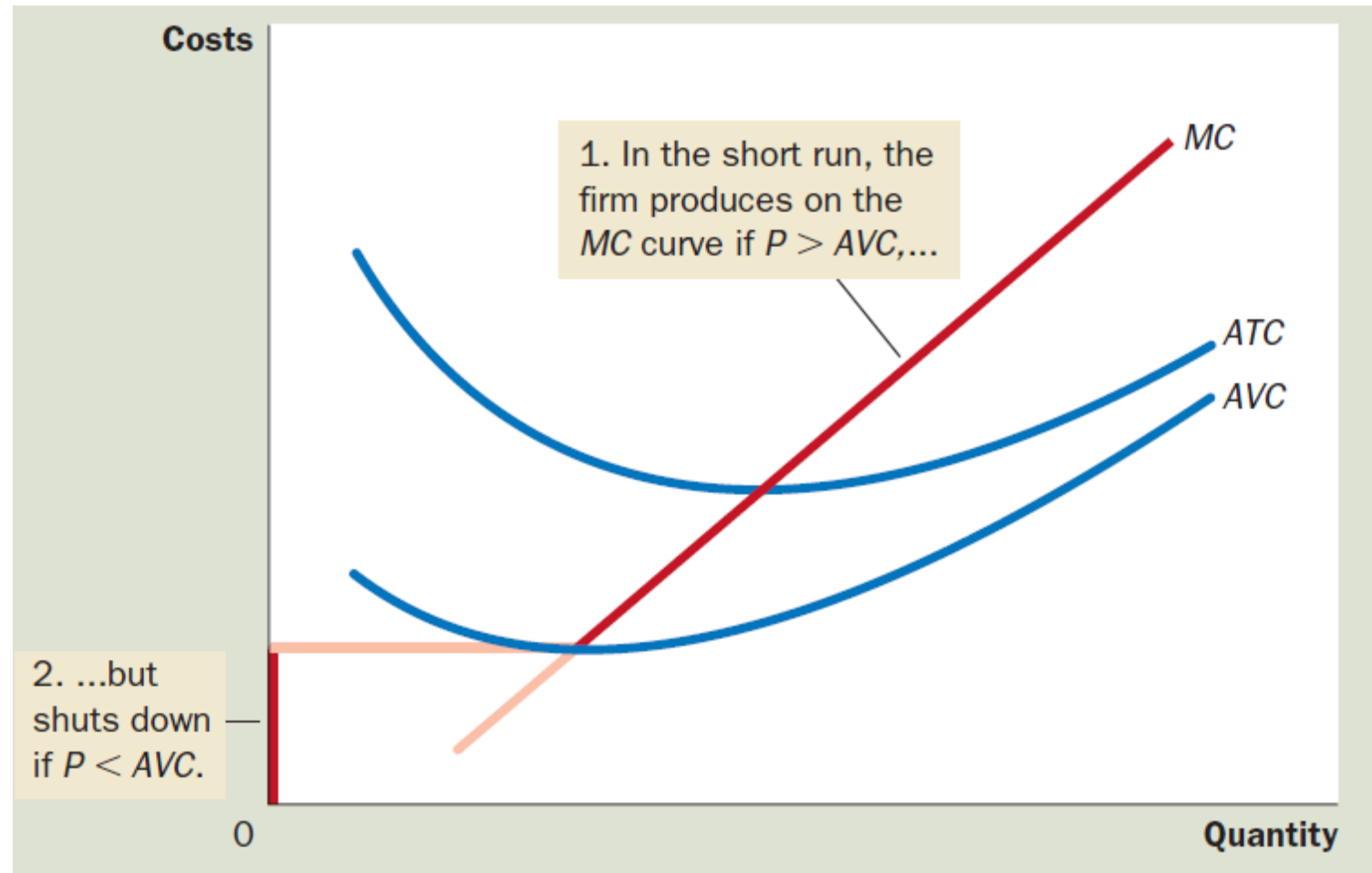
# Long run decision to enter/exit a market

- A firm's long-run decision to exit a market is similar to its shutdown decision. If the firm exits, it will again lose all revenue from the sale of its product, but now it will save not only its variable costs of production but also its fixed costs. Thus, **the firm exits the market if the revenue it would get from producing is less than its total costs.** By dividing both sides of this inequality by the quantity Q, we get

Exit if *P < ATC*

- That is, a firm chooses to exit if the price of its good is less than the average total cost of production.

- A parallel analysis applies to an entrepreneur who is considering starting a firm. The firm will enter the market if such an action would be profitable, which occurs if the price of the good exceeds the average total cost of production.

- **The competitive firm's long-run supply curve is the portion of its marginal-cost curve that lies above average total cost.**

Measuring profit/loss in graphs
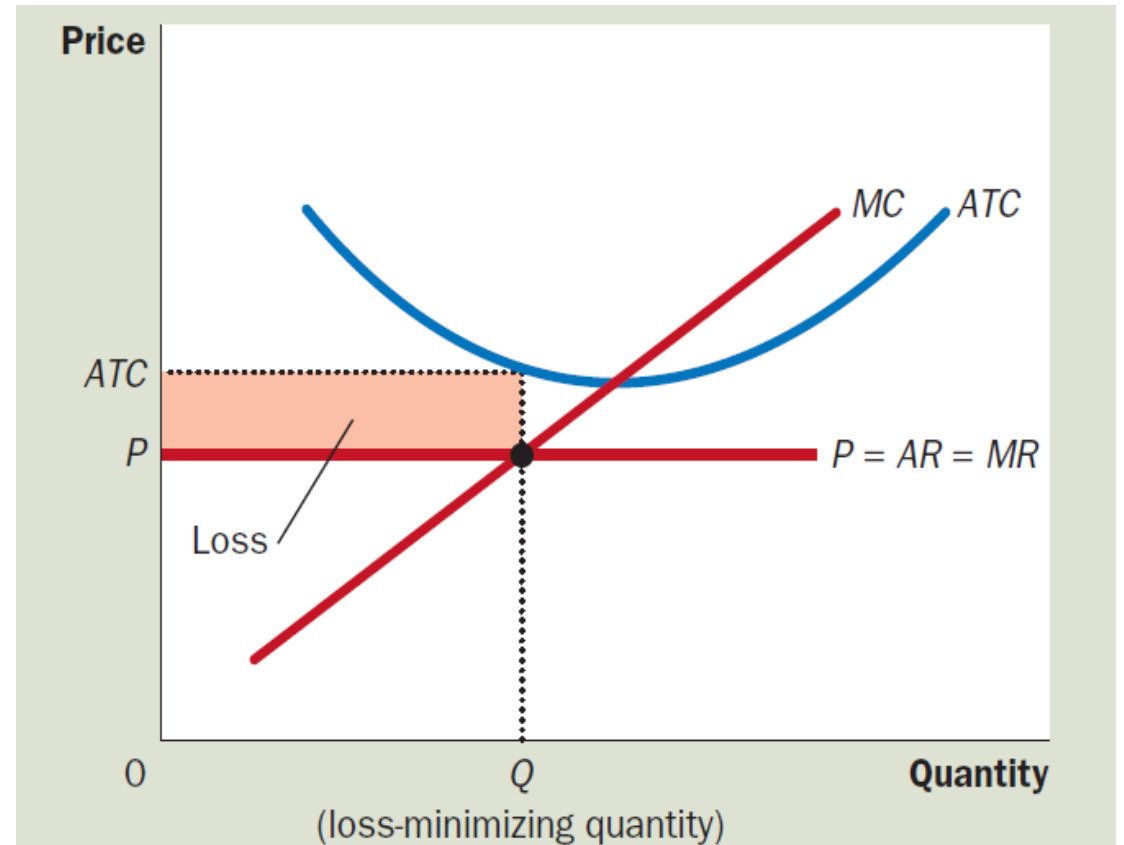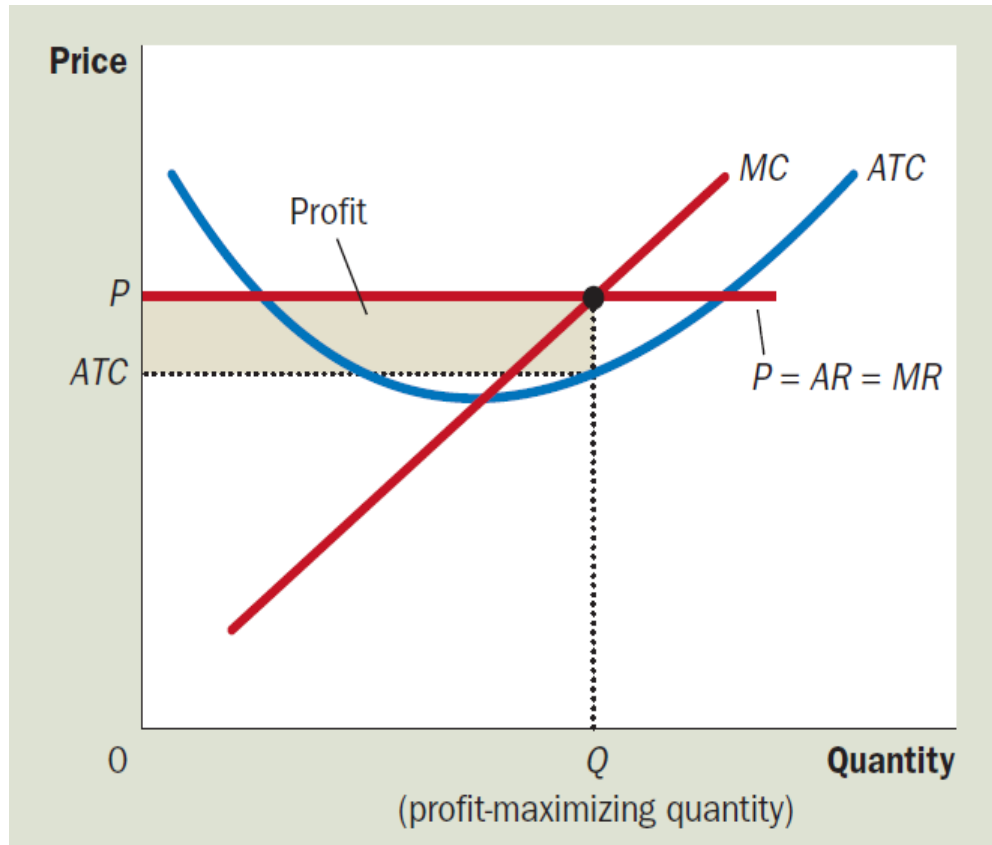
Market Supply in the Long Run

- Consider what happens if firms are able to enter or exit the market. Let's suppose that everyone has access to the same technology for producing the good and access to the same markets to buy the inputs into production. Therefore, all firms and all potential firms have the same cost curves.

- If firms already in the market are profitable, then new firms will have an incentive to enter the market. This entry will expand the number of firms, increase the quantity of the good supplied, and drive down prices and profits. Conversely, if firms in the market are making losses, then some existing firms will exit the market. Their exit will reduce the number of firms, decrease the quantity of the good supplied, and drive up prices and profits.

- **At the end of this process of entry and exit, firms that remain in the market must be making zero economic profit.** The process of entry and exit ends only when price and average total cost are driven to equality.

- We noted that competitive firms maximize profits by choosing a quantity at which price equals marginal cost. We just noted that free entry and exit force price to equal average total cost. But if price is to equal both marginal cost and average total cost, these two measures of cost must equal each other. Marginal cost and average total cost are equal, however, only when the firm is operating at the minimum of average total cost.

- Therefore, **in the long-run equilibrium of a competitive market with free entry and exit, firms must be operating at their efficient scale**.

- Now we can determine the long-run supply curve for the market. In a market with free entry and exit, there is only one price consistent with zero profit—the minimum of average total cost. As a result, **the long-run market supply curve must be horizontal at this price.**

- Any price above this level would generate profit, leading to entry and an increase in the total quantity supplied. Any price below this level would generate losses, leading to exit and a decrease in the total quantity supplied.

Zero Profit Condition and Market Supply
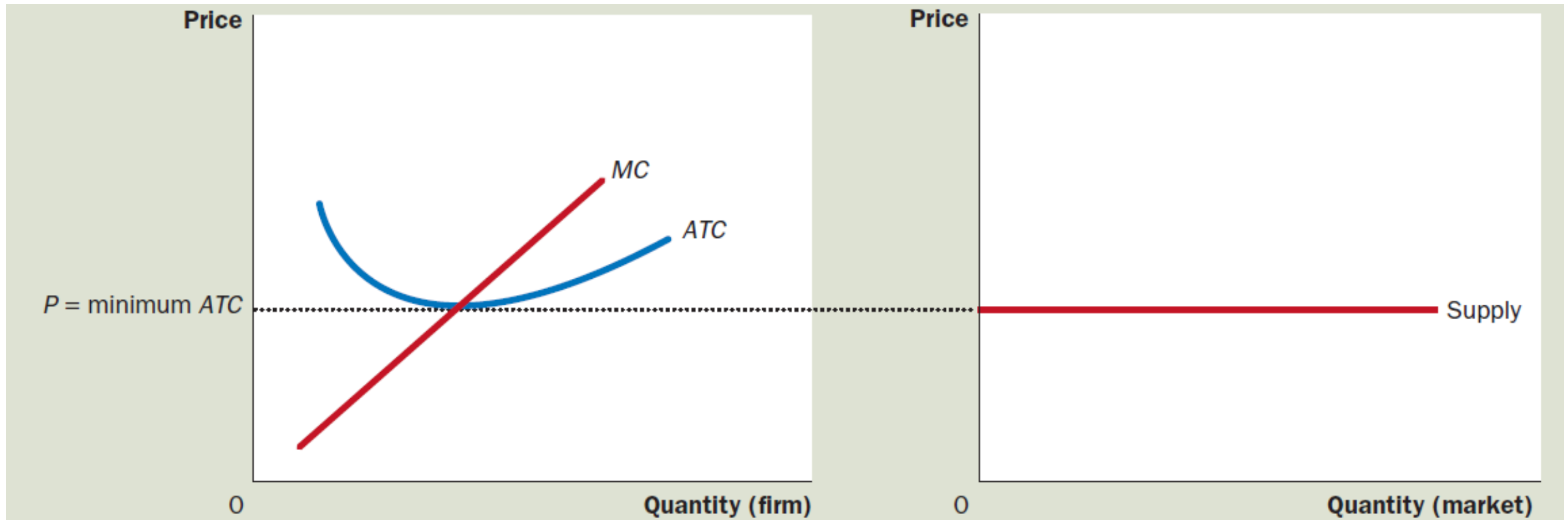
Zero profit?

- To understand the zero-profit condition more fully, recall that profit equals total revenue minus total cost and that total cost includes all the opportunity costs of the firm.

- In particular, total cost includes the time and money that the firm owners devote to the business. In the zero-profit equilibrium, the firm's revenue must compensate the owners for these opportunity costs.

- As a result, in the zero-profit equilibrium, **economic profit is zero, but accounting profit is positive**.

Why long run supply curve might slope upward?

- The long-run market supply curve is horizontal at the minimum of average total cost. When the demand for the good increases, the long-run result is an increase in the number of firms and in the total quantity supplied, without any change in the price.

- There are, however, **two reasons that the long-run market supply curve might slope upward**. The **first is that some resource used in production may be available only in limited quantities**. For example, consider the market for farm products. Anyone can choose to buy land and start a farm, but the quantity of land is limited. As more people become farmers, the price of farmland is bid up, which raises the costs of all farmers in the market. Thus, an increase in demand for farm products cannot induce an increase in quantity supplied without also inducing a rise in farmers' costs, which in turn means a rise in price.

- A second reason for an upward-sloping supply curve is that **firms may have different costs**. Costs vary in part because some people work faster than others and in part because some people have better alternative uses of their time than others. For any given price, those with lower costs are more likely to enter than those with higher costs. As incentive for these new entrants with higher costs, price must rise to make entry profitable for them.

- If firms have different costs, some firms earn profit even in the long run. In this case, the price in the market reflects the average total cost of the *marginal firm*—the firm that would exit the market if the price were any lower. This firm earns zero profit, but firms with lower costs earn positive profit. Entry does not eliminate this profit because would-be entrants have higher costs than firms already in the market. **Higher-cost firms will enter only if the price rises, making the market profitable for them**.

- Thus, for these two reasons, a higher price may be necessary to induce a larger quantity supplied, in which case the long-run supply curve is upward sloping rather than horizontal. **Because firms can enter and exit more easily in the long run than in the short run, the long-run supply curve is typically more elastic than the short-run supply curve.**

Monopoly

Introduction

- Competitive markets, in which there are many firms offering essentially identical products, so each firm has little influence over the price it receives. By contrast, a monopoly such as Microsoft has no close competitors and, therefore, has the power to influence the market price of its product. While a competitive firm is a *price taker*, a monopoly firm is a *price maker.*

- **Market power** alters the relationship between a firm's costs and the price at which it sells its product. A competitive firm takes the price of its output as given by the market and then chooses the quantity it will supply so that price equals marginal cost. By contrast, a monopoly charges a price that exceeds marginal cost.

- A monopoly firm can control the price of the good it sells, but because a high price reduces the quantity that its customers buy, the monopoly's profits are not unlimited.

- Monopoly firms, like competitive firms, aim to maximize profit. But this goal has very different ramifications for competitive and monopoly firms. In competitive markets, self interested consumers and producers behave as if they are guided by an invisible hand to promote general economic well-being.

- By contrast, because monopoly firms are unchecked by competition, the outcome in a market with a monopoly is often not in the best interest of society.

Why Monopolies arise?

- A firm is a **monopoly** if it is the sole seller of its product and if its product does not have close substitutes. The fundamental cause of monopoly is *barriers to entry.* A monopoly remains the only seller in its market because other firms cannot enter the market and compete with it.

- Barriers to entry, have three main sources:

➤*Monopoly resources:* A key resource required for production is owned by a single firm.

➤*Government regulation:* The government gives a single firm the exclusive right to produce some good or service.

➤*The production process:* A single firm can produce output at a lower cost than can a larger number of producers

Monopoly Resources

- A classic example of market power arising from the ownership of a key resource is DeBeers, the South African diamond company. Founded in 1888 by Cecil Rhodes, an English businessman (and benefactor for the Rhodes scholarship), DeBeers has at times controlled up to 80 percent of the production from the world's diamond mines. Because its market share is less than 100 percent, DeBeers is not exactly a monopoly, but the company has nonetheless exerted substantial influence over the market price of diamonds.

- Although exclusive ownership of a key resource is a potential cause of monopoly, **in practice monopolies rarely arise for this reason**. Economies are large, and resources are owned by many people. Indeed, because many goods are traded internationally, the natural scope of their markets is often worldwide.

Government created monopolies

- In many cases, monopolies arise because the government has given one person or firm the exclusive right to sell some good or service.

- The **patent and copyright laws** are two important examples. When a pharmaceutical company discovers a new drug, it can apply to the government for a patent. If the government deems the drug to be truly original, it approves the patent, which gives the company the exclusive right to manufacture and sell the drug for 20 years.

- Similarly, when a novelist finishes a book, she can copyright it. The copyright is a government guarantee that no one can print and sell the work without the author's permission. The copyright makes the novelist a monopolist in the sale of her novel.

- The effects of patent and copyright laws are easy to see. Because these laws give one producer a monopoly, they lead to higher prices than would occur under competition. But by allowing these monopoly producers to charge higher prices and earn higher profits, the laws also encourage some desirable behaviour.

Natural monopolies

- An industry is a **natural monopoly** when a single firm can supply a good or service to an entire market at a lower cost than could two or more firms. **A natural monopoly arises when there are economies of scale** over the relevant range of output.

- In this case, a single firm can produce any amount of output at least cost. That is, for any given amount of output, a larger number of firms leads to less output per firm and higher average total cost.

- An example of a natural monopoly is the distribution of water. To provide water to residents of a town, a firm must build a network of pipes throughout the town. If two or more firms were to compete in the provision of this service, each firm would have to pay the fixed cost of building a network. Thus, the average total cost of water is lowest if a single firm serves the entire market.
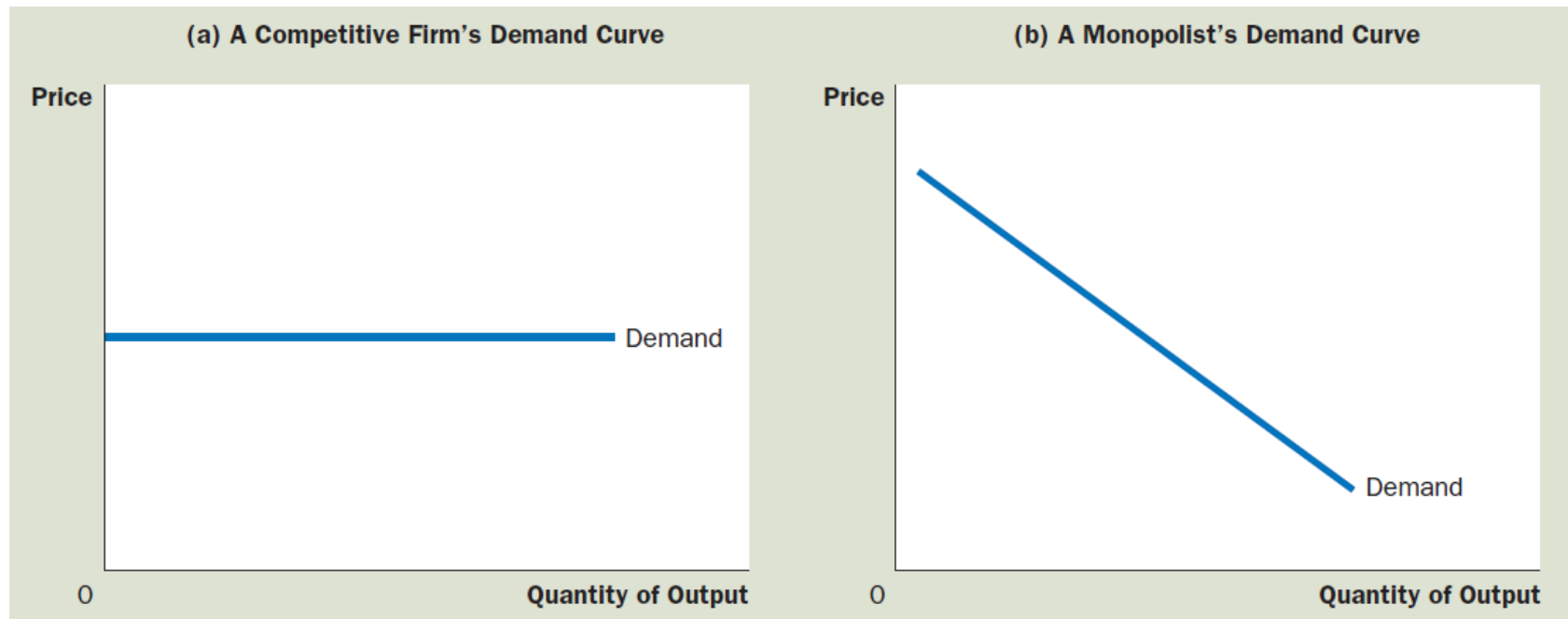
Economies of scale as cause for monopoly
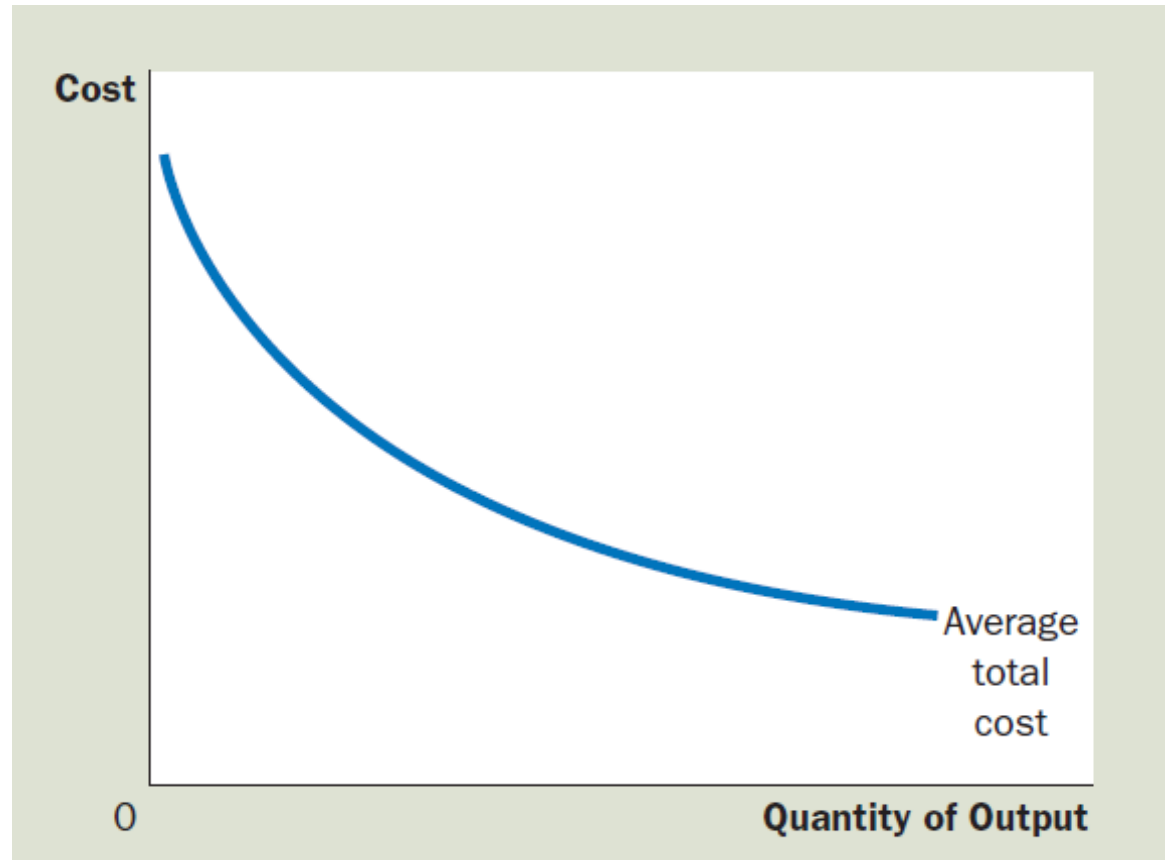
- When a firm is a natural monopoly, it is less concerned about new entrants eroding its monopoly power. Normally, a firm has trouble maintaining a monopoly position without ownership of a key resource or protection from the government. The monopolist's profit attracts entrants into the market, and these entrants make the market more competitive. By contrast, entering a market in which another firm has a natural monopoly is unattractive.

- In some cases, the size of the market is one determinant of whether an industry is a natural monopoly. As a market expands, a natural monopoly can evolve into a more competitive market.

Production and Pricing decisions

- A competitive firm is small relative to the market in which it operates and, therefore, has no power to influence the price of its output. It takes the price as given by market conditions. By contrast, **because a monopoly is the sole producer in its market, it can alter the price of its good by adjusting the quantity it supplies to the market.**

- Because a competitive firm can sell as much or as little as it wants at this price, the competitive firm faces a horizontal demand curve (perfectly elastic)

- By contrast, because a monopoly is the sole producer in its market, i**ts demand curve is the market demand curve**. Thus, the monopolist's demand curve slopes downward. If the monopolist raises the price of its good, consumers buy less of it. The market demand curve provides a constraint on a monopoly's ability to profit from its market power. A monopolist would prefer, if it were possible, to charge a high price and sell a large quantity at that high price.

- The market demand curve describes the combinations of price and quantity that are available to a monopoly firm. By adjusting the quantity produced (or equivalently, the price charged), the monopolist can choose any point on the demand curve, but it cannot choose a point off the demand curve.

(a) A Competitive Firm's Demand Curve

Price

Demand

0   Quantity of Output

(b) A Monopolist's Demand Curve

Price

Demand

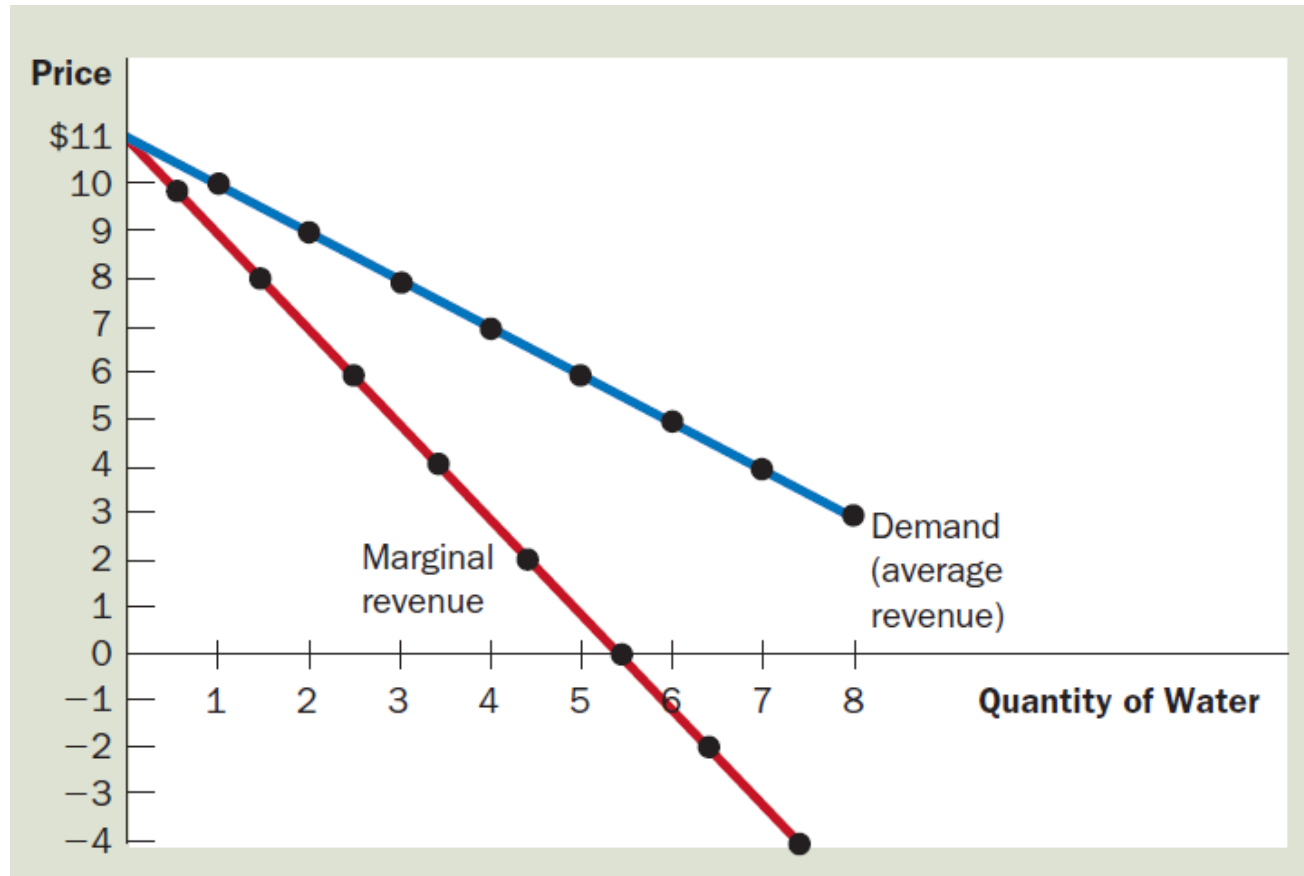0   Quantity of Output

Monopoly Revenue

- Monopolist's total revenue equals the quantity sold times the price. Average revenue is computed by dividing total revenue by the quantity of output.

- Average revenue always equals the price of the good. This is true for monopolists as well as for competitive firms.

- Marginal revenue is the amount of revenue that the firm receives for each additional unit of output. **A monopolist's marginal revenue is always less than the price of its good**. For a monopoly, marginal revenue is lower than price because a monopoly faces a downward-sloping demand curve. To increase the amount sold, a monopoly firm must lower the price it charges to all customers.

- Marginal revenue for monopolies is very different from marginal revenue for competitive firms. When a monopoly increases the amount it sells, this action has two effects on total revenue ($P \times Q$):

➢ *The output effect:* More output is sold, so Q is higher, which tends to increase total revenue.

➢ *The price effect:* The price falls, so P is lower, which tends to decrease total revenue.

- Because a competitive firm can sell all it wants at the market price, there is no price effect. When it increases production by 1 unit, it receives the market price for that unit, and it does not receive any less for the units it was already selling. That is, because the competitive firm is a price taker, its marginal revenue equals the price of its good. **By contrast, when a monopoly increases production by 1 unit, it must reduce the price it charges for every unit it sells, and this cut in price reduces revenue on the units it was already selling**. As a result, a monopoly's marginal revenue is less than its price.

- **Marginal revenue can even become negative**. Marginal revenue is negative when the price effect on revenue is greater than **the output effect. In this case, when the firm produces an extra unit of output, the price falls by enough to cause the firm's total revenue to decline**, even though the firm is selling more units.

# Demand and Marginal Revenue for Monopoly

Profit Maximization

- As with competitive firms, we assume that the monopolist's goal is to maximize profit. The monopolist's **profit maximizing quantity of output is determined by the intersection of the marginal-revenue curve and the marginal-cost curve.**

- After the monopoly firm chooses the quantity of output that equates marginal revenue and marginal cost, it uses the demand curve to find the highest price it can charge and sell that quantity. In the following figure the profit-maximizing price is found at point B.

Monopoly price at maximum profit
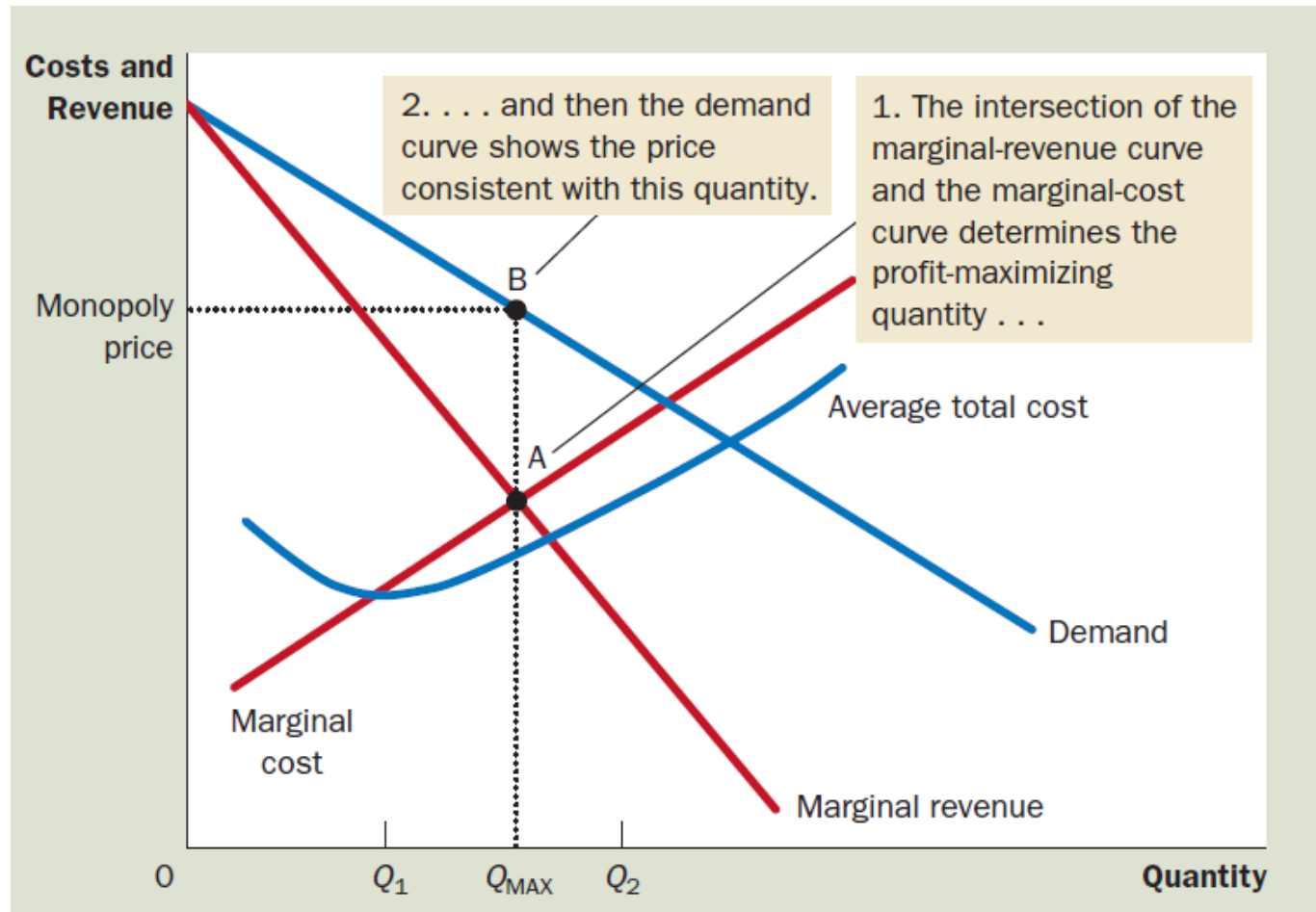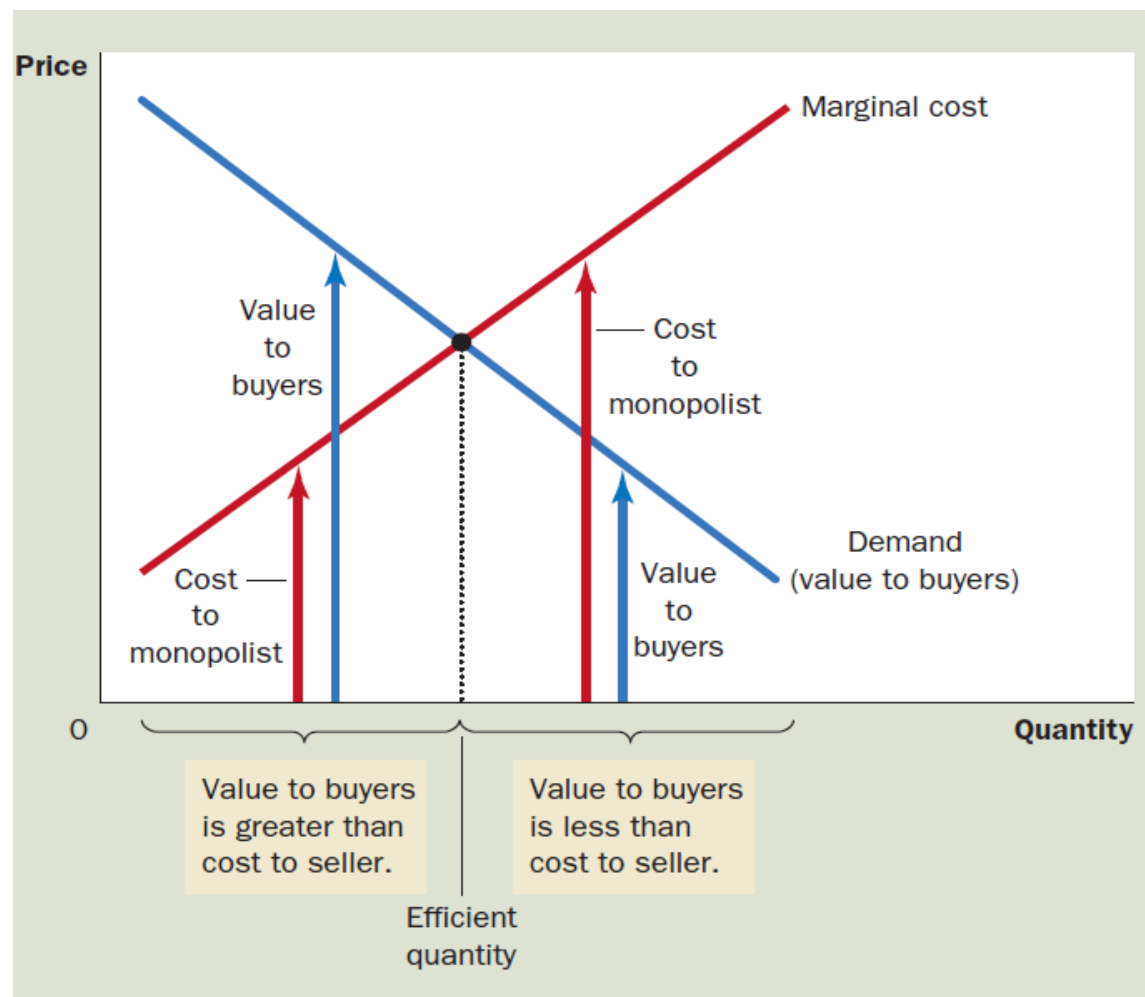
Monopolist's Profit
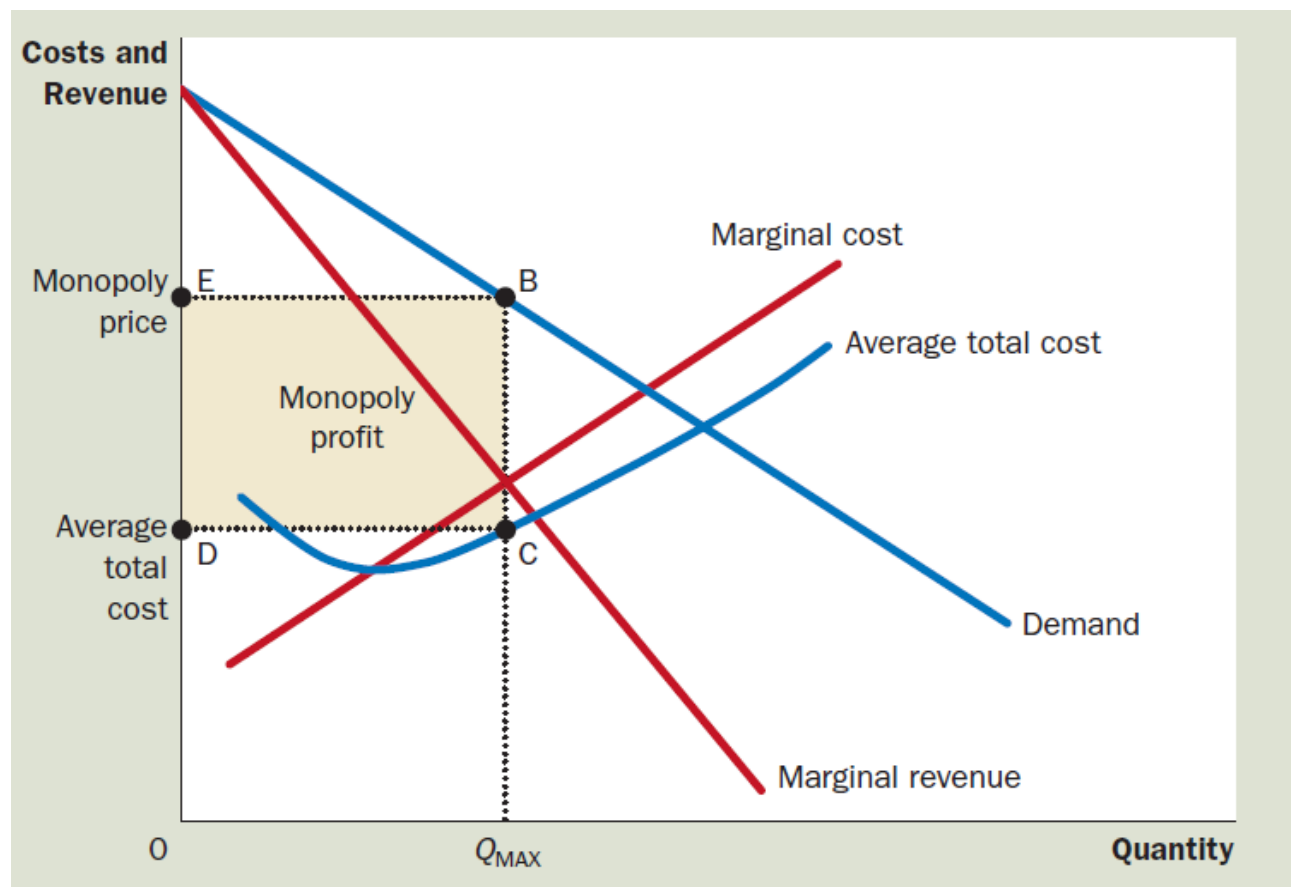
Welfare cost of Monopolies

- A monopoly, in contrast to a competitive firm, charges a price above marginal cost. From the standpoint of consumers, this high price makes monopoly undesirable. At the same time, however, the monopoly is earning profit from charging this high price. From the standpoint of the owners of the firm, the high price makes monopoly very desirable.

- So does the benefits to owners outweigh the costs imposed on consumers?

- Total surplus measures the economic well-being of buyers and sellers in a market. Total surplus is the sum of consumer surplus and producer surplus. Consumer surplus is consumers' willingness to pay for a good minus the amount they actually pay for it. Producer surplus is the amount producers receive for a good minus their costs of producing it.

- The demand curve reflects the value of the good to consumers, as measured by their willingness to pay for it. The marginal-cost curve reflects the costs of the monopolist. Thus, **the socially efficient quantity is found where the demand curve and the marginal-cost curve intersect**.

- Below this quantity, the value of an extra unit to consumers exceeds the cost of providing it, so increasing output would raise total surplus. Above this quantity, the cost of producing an extra unit exceeds the value of that unit to consumers, so decreasing output would raise total surplus. At the optimal quantity, the value of an extra unit to consumers exactly equals the marginal cost of production.

- If a social planner were running the monopoly, the firm could achieve this efficient outcome by charging the price found at the intersection of the demand and marginal-cost curves. Thus, like a competitive firm and unlike a profit maximizing monopoly, a social planner would charge a price equal to marginal cost. Because this price would give consumers an accurate signal about the cost of producing the good, consumers would buy the efficient quantity.

The Efficient Level of Output

- When a monopolist charges a price above marginal cost, some potential consumers value the good at more than its marginal cost but less than the monopolist's price. These consumers do not buy the good. Because the value these consumers place on the good is greater than the cost of providing it to them, this result is inefficient. Thus, monopoly pricing prevents some mutually beneficial trades from taking place.

- The **inefficiency of monopoly can be measured with a deadweight loss triangle**. Because the demand curve reflects the value to consumers and the marginal-cost curve reflects the costs to the monopoly producer, the area of the deadweight loss triangle between the demand curve and the marginal-cost curve equals the total surplus lost because of monopoly pricing. It is the reduction in economic well-being that results from the monopoly's use of its market power.

Deadweight loss of Monopoly
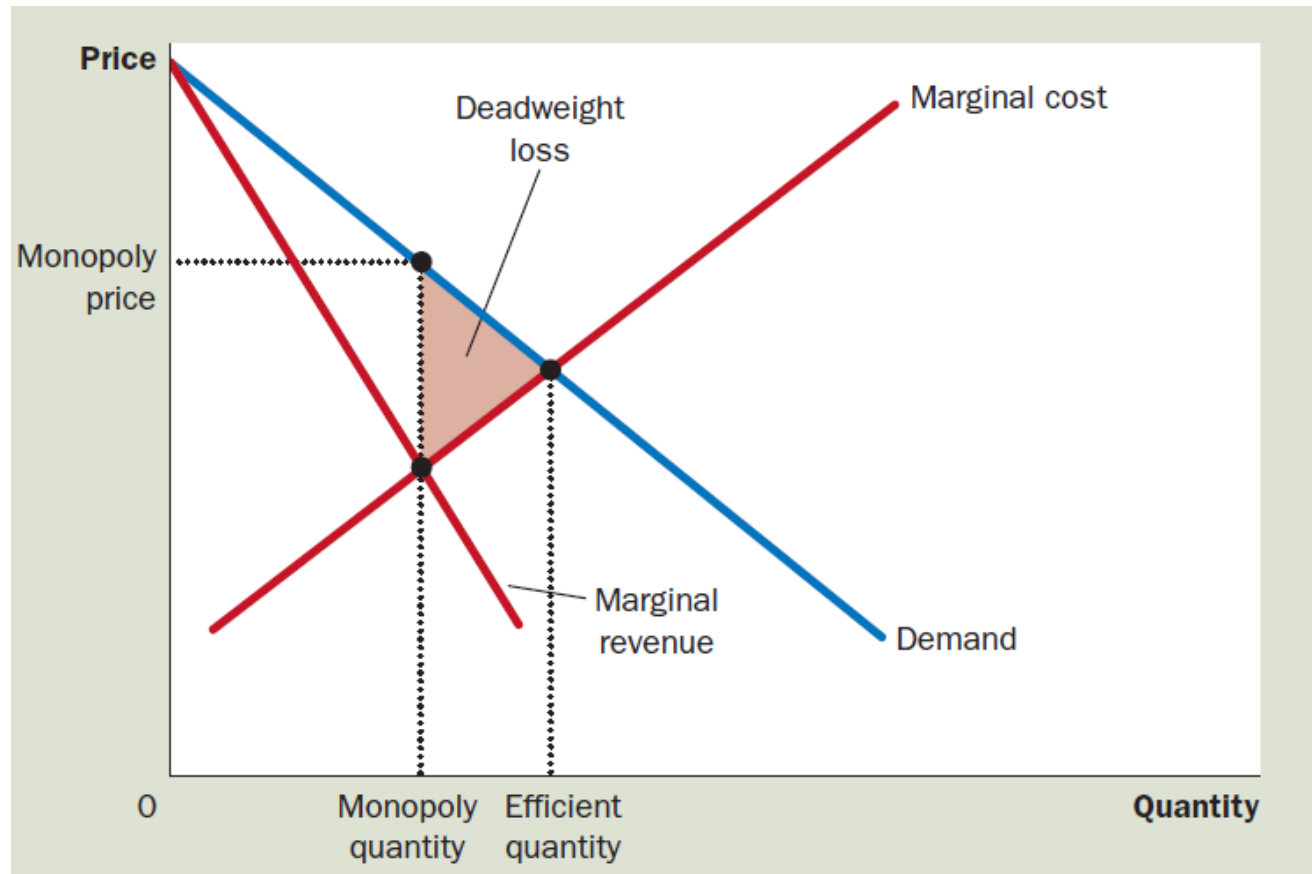
- Whenever a consumer pays an extra rupee to a producer because of a monopoly price, the consumer is worse off by a rupee, and the producer is better off by the same amount. This transfer from the consumers of the good to the owners of the monopoly does not affect the market's total surplus— the sum of consumer and producer surplus.

- In other words, the monopoly profit itself represents not a reduction in the size of the economic pie but merely a bigger slice for producers and a smaller slice for consumers. Unless consumers are for some reason more deserving than producers—a normative judgment about equity that goes beyond the realm of economic efficiency—the monopoly profit is not a social problem.

- The problem in a monopolized market arises because the firm produces and sells a quantity of output below the level that maximizes total surplus. The deadweight loss measures how much the economic pie shrinks as a result. This inefficiency is connected to the monopoly's high price: Consumers buy fewer units when the firm raises its price above marginal cost. But keep in mind that the profit earned on the units that continue to be sold is not the problem. The problem stems from the inefficiently low quantity of output.

Price discrimination

- In many cases, firms sell the same good to different customers for different prices, even though the costs of producing for the two customers are the same. This practice is called **price discrimination**.

- Price discrimination is a **rational strategy for a profit-maximizing monopolist**. That is, by charging different prices to different customers, a monopolist can increase its profit. In essence, a price discriminating monopolist charges each customer a price closer to his or her willingness to pay, therefore selling more than is possible with a single price.

- **Price discrimination requires the ability to separate customers according to their willingness to pay**. Customers could be separated geographically. But sometimes monopolists choose other differences, such as age or income, to distinguish among customers.

- Certain market forces can prevent firms from price discriminating. In particular, one such force is *arbitrage*, the process of buying a good in one market at a low price and selling it in another market at a higher price to profit from the price difference.

- **Price discrimination can raise economic welfare**. Thus price discrimination can eliminate the inefficiency inherent in monopoly pricing.

- The following figure shows producer and consumer surplus with and without price discrimination. Without price discrimination, the firm charges a single price above marginal cost, as shown in panel (a). Because some potential customers who value the good at more than marginal cost do not buy it at this high price, the monopoly causes a deadweight loss.

- Yet **when a firm can perfectly price discriminate**, as shown in panel (b), each customer who values the good at more than marginal cost buys the good and is charged his or her willingness to pay. All mutually beneficial trades take place, **there is no deadweight loss**, and the entire surplus derived from the market goes to the monopoly producer in the form of profit.

- **In reality, of course, price discrimination is not perfect**. Instead, firms price discriminate by dividing customers into groups: young versus old, weekday versus weekend shoppers. The implication of imperfect price discrimination on total welfare is complicated. Compared to the monopoly outcome with a single price, imperfect price discrimination can raise, lower, or leave unchanged total surplus in a market. The only certain conclusion is that price discrimination raises the monopoly's profit; otherwise, the firm would choose to charge all customers the same price.

Welfare with and without price discrimination

(a) Monopolist with Single Price

(b) Monopolist with Perfect Price Discrimination
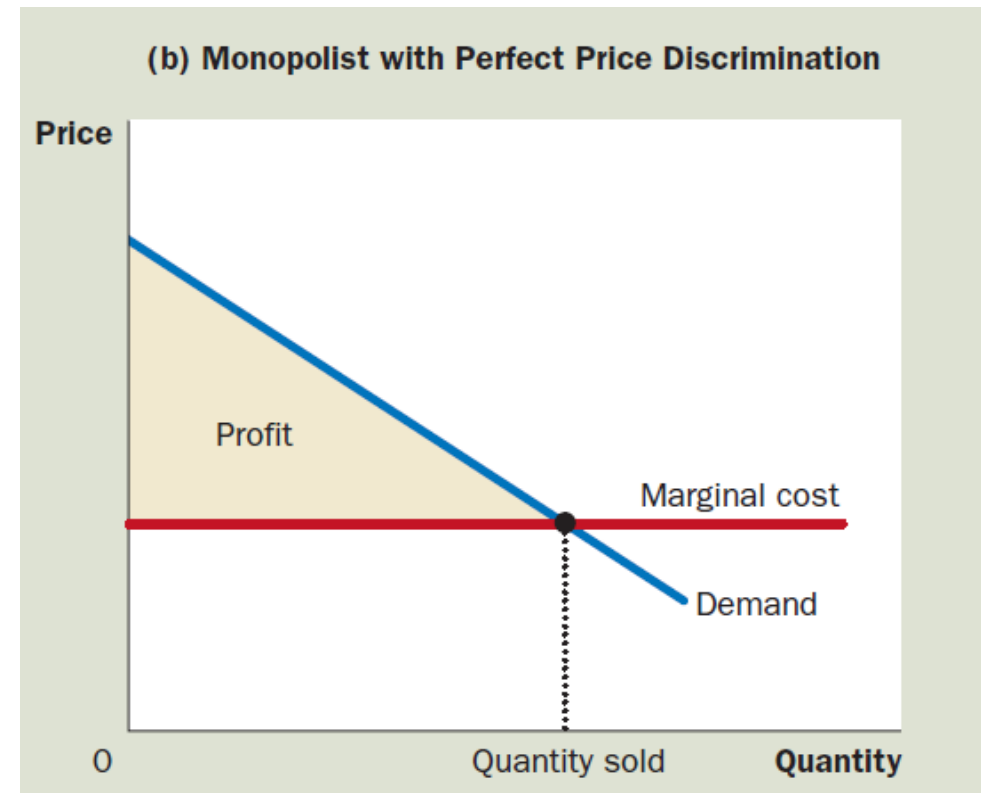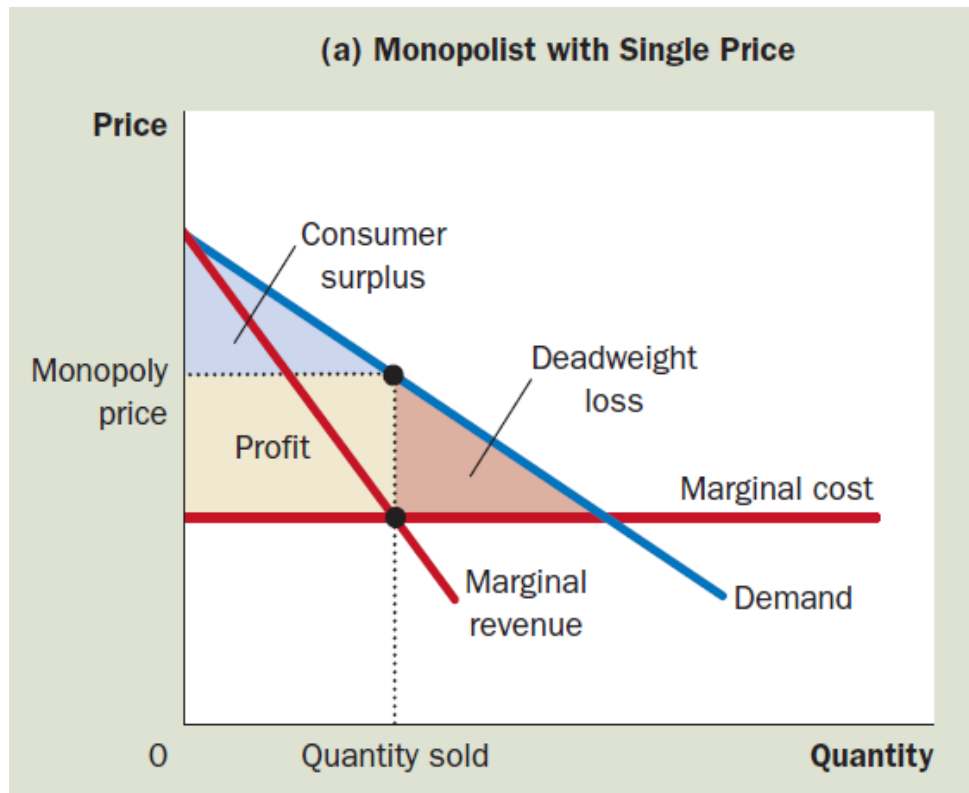
Examples of Price discrimination

- Movie tickets

- Airlines

- Quantity discounts- monopolists can also price discriminate by charging different prices to the same customer for different units that the customer buys. For example, many firms offer lower prices to customers who buy large quantities. Quantity discounts are often a successful way of price discriminating because a customer's willingness to pay for an additional unit declines as the customer buys more units.

Public Polices towards Monopoly

- Policymakers in the government can respond to the problem of monopoly in one of three ways:

➢ **By trying to make monopolized industries more competitive-** Competition Act, 2002. Antitrust laws have costs as well as benefits. Sometimes companies merge not to reduce competition but to lower costs through more efficient joint production. These benefits from mergers are called *synergies*. For example, SBI merger. If antitrust laws are to raise social welfare, the government must be able to determine which mergers are desirable and which are not.

- **By regulating the behavior of the monopolies-** imposing marginal cost pricing. But this faces a hurdle as monopolies have declining average total cost. The following figure shows a firm with a large fixed cost and then constant marginal cost thereafter. If regulators were to set price equal to marginal cost, that price must be less than the firm's average total cost, and the firm would lose money. Instead of charging such a low price, the monopoly firm would just exit the industry.

➢ **By turning some private monopolies into public enterprises-** governments can run natural monopolies like utilities but even then bureaucrats may form a special interest group and can block cost reducing reforms.

Marginal cost pricing for a Natural Monopoly
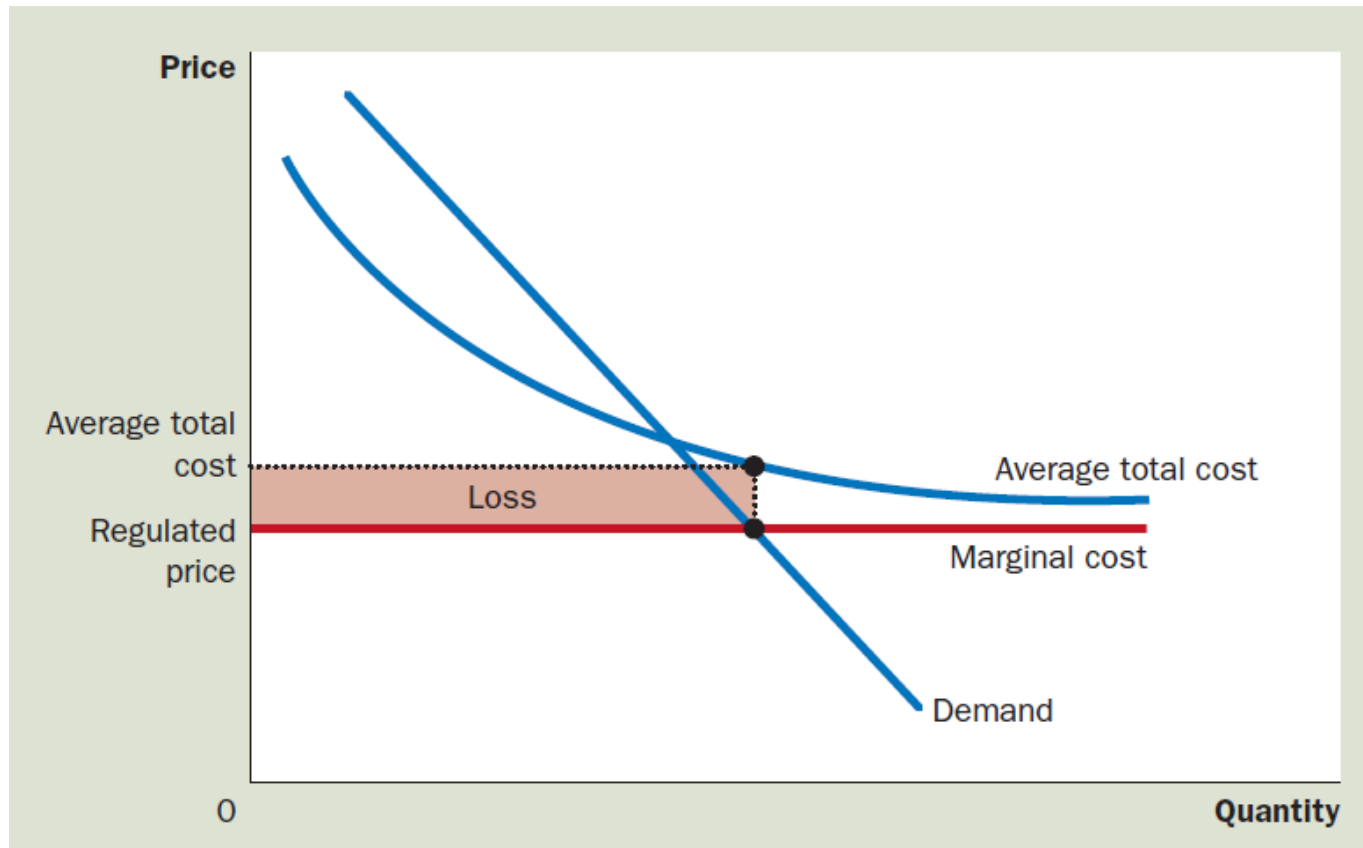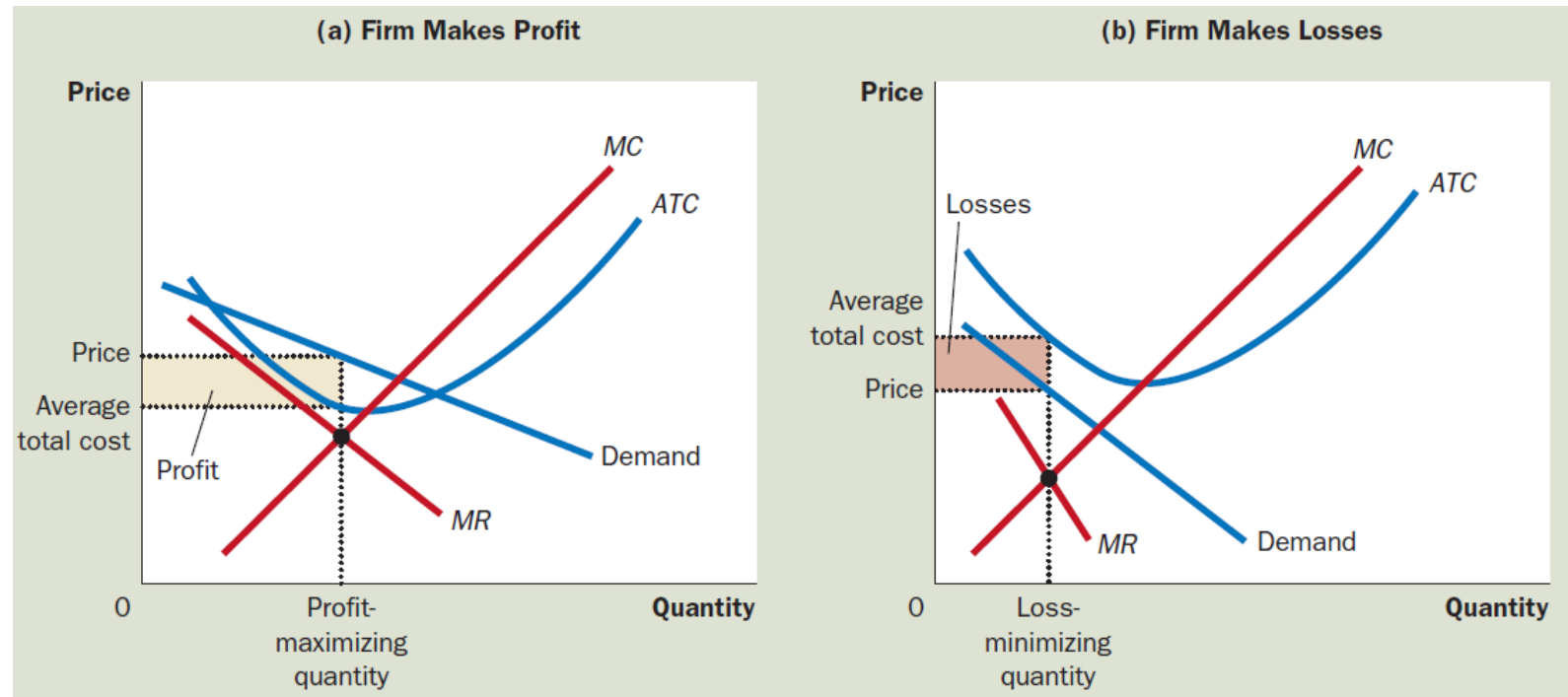
Monopolistic Competition

Introduction

- Competition and monopoly are extreme forms of market structure. Competition occurs when there are many firms in a market offering essentially identical products; monopoly occurs when there is only one firm in a market.

- Although the cases of perfect competition and monopoly illustrate some important ideas about how markets work, most markets in the economy include elements of both these cases and, therefore, are not completely described by either of them. The typical firm in the economy faces competition, but the competition is not so rigorous as to make the firm a price taker.

- The typical firm also has some degree of market power, but its market power is not so great that the firm can be described exactly by the monopoly model. In other words, many industries fall somewhere between the polar cases of perfect competition and monopoly. Economists call this situation **imperfect competition**.

- One type of imperfectly competitive market is an **oligopoly**, which is a market with only a few sellers, each offering a product that is similar or identical to the products offered by other sellers. Economists measure a market's domination by a small number of firms with a statistic called the *concentration ratio*.

- A second type of imperfectly competitive market is called **monopolistic competition**. This describes a market structure in which there are many firms selling products that are similar but not identical. In a monopolistically competitive market, each firm has a monopoly over the product it makes, but many other firms make similar products that compete for the same customers.

- To be more precise, monopolistic competition describes a market with the following attributes:

➢ ***Many sellers****:* There are many firms competing for the same group of customers.

➢ ***Product differentiation****:* Each firm produces a product that is at least slightly different from those of other firms. Thus, rather than being a price taker, each firm faces a downward-sloping demand curve.

- ***Free entry and exit****:* Firms can enter or exit the market without restriction. Thus, the number of firms in the market adjusts until economic profits are driven to zero

Short run for a Monopolistically Competitive Firm

- Each firm in a monopolistically competitive market is, in many ways, like a monopoly. Because its product is different from those offered by other firms, **it faces a downward-sloping demand curve**. A monopolistically competitive firm chooses to produce the quantity at which marginal revenue equals marginal cost and then uses its demand curve to find the price at which it can sell that quantity.

Long run for a Monopolistically Competitive Firm

- When firms are making profits, new firms have an incentive to enter the market. This entry increases the number of products from which customers can choose and, therefore, reduces the demand faced by each firm already in the market. In other words, profit encourages entry, and entry shifts the demand curves faced by the incumbent firms to the left. As the demand for incumbent firms' products falls, these firms experience declining profit.

- Conversely, when firms are making losses, firms in the market have an incentive to exit. As firms exit, customers have fewer products from which to choose. This decrease in the number of firms expands the demand faced by those firms that stay in the market. In other words, losses encourage exit, and exit shifts the demand curves of the remaining firms to the right. As the demand for the remaining firms' products rises, these firms experience rising profit (that is, declining losses).

- This process of entry and exit continues until the firms in the market are making exactly zero economic profit. Once the market reaches this equilibrium, new firms have no incentive to enter, and existing firms have no incentive to exit.

- Notice that the demand curve in the following figure just barely touches the average total cost curve. These two curves must be tangent once entry and exit have driven profit to zero. Because profit per unit sold is the difference between price (found on the demand curve) and average total cost, the maximum profit is zero only if these two curves touch each other without crossing.

- Also note that this point of tangency occurs at the same quantity where marginal revenue equals marginal cost. This is required because this particular quantity maximizes profit and the maximum profit is exactly zero in the long run.

- To sum up, two characteristics describe the long-run equilibrium in a monopolistically competitive market

➤**As in a monopoly market, price exceeds marginal cost.** This conclusion arises because profit maximization requires marginal revenue to equal marginal cost and because the downward-sloping demand curve makes marginal revenue less than the price.

➤**As in a competitive market, price equals average total cost**. This conclusion arises because free entry and exit drive economic profit to zero.

Long Run equilibrium
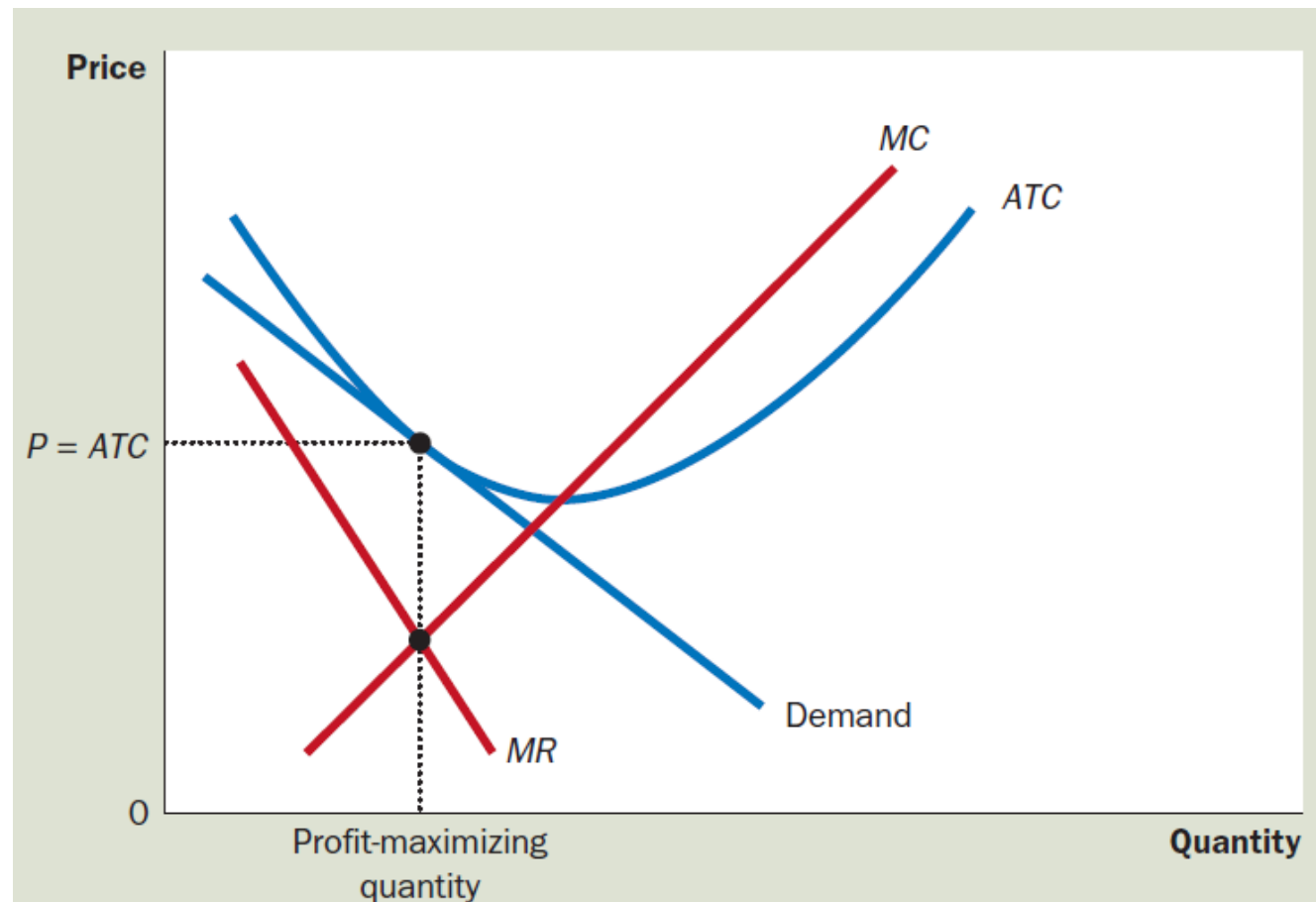
- **The second characteristic shows how monopolistic competition differs from monopoly**. Because a monopoly is the sole seller of a product without close substitutes, it can earn positive economic profit, even in the long run. By contrast, because there is free entry into a monopolistically competitive market, the economic profit of a firm in this type of market is driven to zero.

Monopolistic versus Perfect Competition

- In the comparison of long equilibrium of perfect competition and monopolistic competition, **there are two noteworthy differences-excess capacity and the markup**
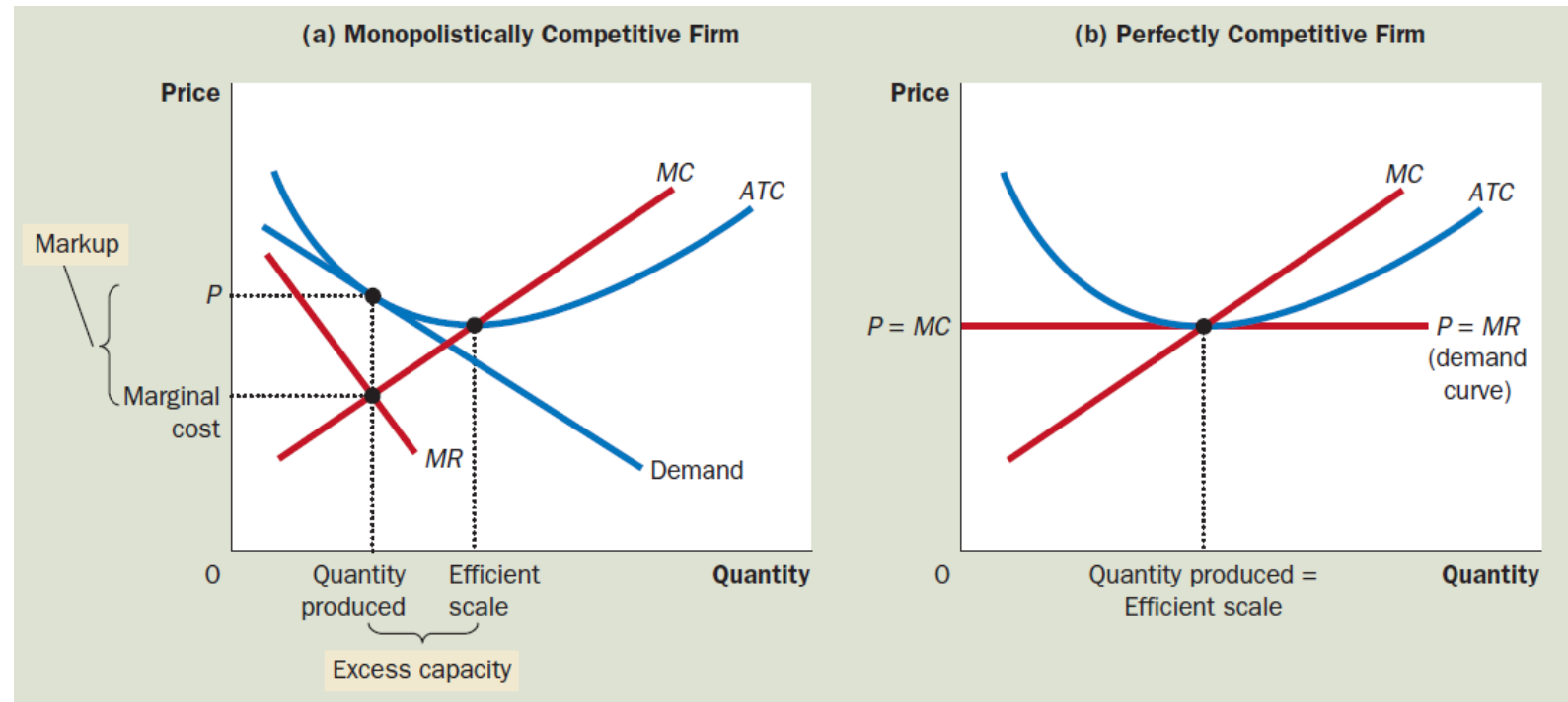
Excess capacity

- Entry and exit drive each firm in a monopolistically competitive market to a point of tangency between its demand and average-total-cost curves. The quantity of output at this point is smaller than the quantity that minimizes average total cost. Thus, under monopolistic competition, firms produce on the downward-sloping portion of their average-total-cost curves. In this way, monopolistic competition contrasts starkly with perfect competition.

- Free entry in competitive markets drives firms to produce at the minimum of average total cost. **The quantity that minimizes average total cost is called the efficient scale of the firm**. In the long run, perfectly competitive firms produce at the efficient scale whereas monopolistically competitive firms produce below this level.

- **Firms are said to have excess capacity under monopolistic competition**. In other words, a monopolistically competitive firm, unlike a perfectly competitive firm, could increase the quantity it produces and lower the average total cost of production. The firm forgoes this opportunity because it would need to cut its price to sell the additional output. It is more profitable for a monopolistic competitor to continue operating with excess capacity.

Markup over marginal cost

- A second difference between perfect competition and monopolistic competition is the relationship between price and marginal cost.

- For a competitive firm, price equals marginal cost. For a monopolistically competitive firm price exceeds marginal cost because the firm always has some market power.

- How is this markup over marginal cost consistent with free entry and zero profit? The **zero-profit condition ensures only that price equals average total cost**. It does *not* ensure that price equals marginal cost.

- Indeed, in the long-run equilibrium, monopolistically competitive firms operate on the declining portion of their average-total-cost curves, so marginal cost is below average total cost. Thus, for price to equal average total cost, price must be above marginal cost.

Monopolistic Competition and Welfare

- Competitive markets lead to efficient outcomes, unless there are externalities, and that monopoly markets lead to deadweight losses. Monopolistically competitive markets are more complex than either of these polar cases, so evaluating welfare in these markets is a more subtle exercise.

- **One source of inefficiency is the markup of price over marginal cost.** Because of the markup, some consumers who value the good at more than the marginal cost of production (but less than the price) will be deterred from buying it. Thus, a monopolistically competitive market has the normal deadweight loss of monopoly pricing.

- Although this outcome is undesirable compared to the first-best outcome of price equal to marginal cost, there is no easy way for policymakers to fix the problem. To enforce marginal-cost pricing, policymakers would need to regulate all firms that produce differentiated products. Because such products are so common in the economy, the administrative burden of such regulation would be overwhelming.

- Moreover, regulating monopolistic competitors would entail all the problems of regulating natural monopolies. In particular, because monopolistic competitors are making zero profits already, requiring them to lower their prices to equal marginal cost would cause them to make losses. To keep these firms in business, the government would need to help them cover these losses. Rather than raise taxes to pay for these subsidies, policymakers may decide it is better to live with the inefficiency of monopolistic pricing.

- **Another way in which monopolistic competition may be socially inefficient is that the number of firms in the market may not be "ideal."** That is, there may be too much or too little entry. One way to think about this problem is in terms of the externalities associated with entry.

- Whenever a new firm considers entering the market with a new product, it considers only the profit it would make. Yet its entry would also have two effects that are external to the firm:

➢**The product-variety externality:** Because consumers get some consumer surplus from the introduction of a new product, entry of a new firm conveys a positive externality on consumers.

➢**The business-stealing externality**: Because other firms lose customers and profits from the entry of a new competitor, entry of a new firm imposes a negative externality on existing firms.

- Thus, in a monopolistically competitive market, there are positive and negative externalities associated with the entry of new firms. Depending on which externality is larger, a monopolistically competitive market could have either too few or too many products.

Advertising

- Advertising behavior is a natural feature of monopolistic competition (as well as some oligopolistic industries). When firms sells differentiated products and charge prices above marginal cost, each firm has an incentive to advertise to attract more buyers to its particular product.

- Assessing the social value of advertising is difficult and often generates heated argument among economists. **Critics of advertising argue that firms advertise to manipulate people's tastes and that such advertising is psychological rather than informational**. They also argue that advertising impedes competition. Advertising often tries to convince consumers that products are more different than they truly are. By increasing the perception of product differentiation and fostering brand loyalty, advertising makes buyers less concerned with price differences among similar goods. With a less elastic demand curve, each firm charges a larger markup over marginal cost.

- **Defenders of advertising argue that firms use advertising to provide information to customers**. Advertising conveys the prices of the goods offered for sale, the existence of new products, and the locations of retail outlets. This information allows customers to make better choices about what to buy and, thus, enhances the ability of markets to allocate resources efficiently.

- **Defenders also argue that advertising fosters competition**. Because advertising allows customers to be more fully informed about all the firms in the market, customers can more easily take advantage of price differences. Thus, each firm has less market power. In addition, advertising allows new firms to enter more easily because it gives entrants a means to attract customers from existing firms.

Two notable views on advertising

- **John Kenneth Galbraith's** most famous book was *The Affluent Society,* published in 1958. In it, he argued that corporations use advertising to create demand for products that people otherwise do not want or need. The market system should not be applauded, he believed, for satisfying desires that it has itself created.

- **Frederic Hayek** observed that advertising was merely one example of a larger phenomenon: Our social environment creates many of our preferences. Literature, art, and music are all acquired tastes. A person's demand for hearing a Mozart concerto may have been created in a music appreciation class, but this fact does not make the desire less legitimate or the music professor a sinister influence. Hayek concluded, "It is because each individual producer thinks that the consumers can be persuaded to like his products that he endeavors to influence them. But though this effort is part of the influences which shape consumers' taste, no producer can in any real sense 'determine' them."

Brand names

- Advertising is closely related to the existence of brand names. In many markets, there are two types of firms. Some firms sell products with widely recognized brand names, while other firms sell generic substitutes. Most often, the firm with the brand name spends more on advertising and charges a higher price for its product.

- Critics argue that brand names cause consumers to perceive differences that do not really exist. In many cases, the generic good is almost indistinguishable from the brand-name good. Consumers' willingness to pay more for the brand-name good, these critics assert, is a form of irrationality fostered by advertising.

- Economist Edward Chamberlin, one of the early developers of the theory of monopolistic competition, concluded from this argument that brand names were bad for the economy. He proposed that the government discourage their use by refusing to enforce the exclusive trademarks that companies use to identify their products.

- More recently, economists have defended brand names as a useful way for consumers to ensure that the goods they buy are of high quality. There are two related arguments. **First, brand names provide consumers with information about quality** when quality cannot be easily judged in advance of purchase. **Second, brand names give firms an incentive to maintain high quality** because firms have a financial stake in maintaining the reputation of their brand names.

Oligopoly

Introduction

- The essence of an oligopolistic market is that there are only a few sellers. As a result, the actions of any one seller in the market can have a large impact on the profits of all the other sellers.

- Oligopolistic firms are interdependent in a way that competitive firms are not. This interdependence shapes the firms' behaviour and raises problems for public policy.

- The analysis of oligopoly offers an opportunity to introduce **game theory**, the study of how people behave in strategic situations. By "strategic" we mean a situation in which a person, when choosing among alternative courses of action, must consider how others might respond to the action he takes.

- Because oligopolistic markets have only a small number of firms, each firm must act strategically. Each firm knows that its profit depends not only on how much it produces but also on how much the other firms produce. In making its production decision, each firm in an oligopoly should consider how its decision might affect the production decisions of all the other firms.

- Because an oligopolistic market has only a small group of sellers, **a key feature of oligopoly is the tension between cooperation and self-interest**. The group of oligopolists is best off cooperating and acting like a monopolist—producing a small quantity of output and charging a price above marginal cost.

- Yet because each oligopolist cares only about its own profit, there are powerful incentives at work that hinder a group of firms from maintaining the monopoly outcome.

Duopoly as a case of Oligopoly

- Oligopolists would like to form cartels and earn monopoly profits, but that is often impossible. Squabbling among cartel members over how to divide the profit in the market can make agreement among them difficult. In addition, antitrust laws prohibit explicit agreements among oligopolists as a matter of public policy.

- One might expect Jack and Jill to reach the monopoly outcome on their own, because this outcome maximizes their joint profit. In the absence of a binding agreement, however, the monopoly outcome is unlikely.

- If the duopolists individually pursue their own self-interest when deciding how much to produce, they produce a total quantity greater than the monopoly quantity, charge a price lower than the monopoly price, and earn total profit less than the monopoly profit.

Demand Schedule for Water

Quantity	Price	Total Revenue (and total profit)
0 gallons	$120	$ 0
10	110	1,100
20	100	2,000
30	90	2,700
40	80	3,200
50	70	3,500
60	60	3,600
70	50	3,500
80	40	3,200
90	30	2,700
100	20	2,000
110	10	1,100
120	0	0

- Although the logic of self-interest increases the duopoly's output above the monopoly level, **it does not push the duopolists to reach the competitive allocation**. Like monopolists, oligopolists are aware that increasing the amount they produce reduces the price of their product, which in turn affects profits. Therefore, they stop short of following the competitive firm's rule of producing up to the point where price equals marginal cost.

- The outcome in which Jack and Jill each produce 40 gallons looks like **some sort of equilibrium. In fact, this outcome is called a Nash equilibrium. A Nash equilibrium is a situation in which economic actors interacting with one another each choose their best strategy given the strategies the others have chosen**. Once they reach this Nash equilibrium, neither Jack nor Jill has an incentive to make a different decision.

- This example illustrates the tension between cooperation and self-interest. **Oligopolists would be better off cooperating and reaching the monopoly outcome. Yet because they pursue their own self-interest, they do not end up reaching the monopoly outcome and maximizing their joint profit**. Each oligopolist is tempted to raise production and capture a larger share of the market. As each of them tries to do this, total production rises, and the price falls.

- In summary, when firms in an oligopoly individually choose production to maximize profit, **they produce a quantity of output greater than the level produced by monopoly and less than the level produced by competition. The oligopoly price is less than the monopoly price but greater than the competitive price** (which equals marginal cost).

Choosing a strategy

- If there are two firms in the market and they are producing a homogeneous product, then there are four variables of interest: the price that each firm charges and the quantities that each firm produces. When one firm decides about its choices for prices and quantities it may already know the choices made by the other firm. If one firm gets to set its price before the other firm, we call it the price leader and the other firm the price follower.

- Similarly, one firm may get to choose its quantity first, in which case it is a quantity leader and the other is a quantity follower. The strategic interactions in these cases form a sequential game.

- On the other hand, it may be that when one firm makes its choices it doesn't know the choices made by the other firm. In this case, it has to guess about the other firm's choice in order to make a sensible decision itself. This is a simultaneous game. Again there are two possibilities: the firms could each simultaneously choose prices or each simultaneously choose quantities.

- This classification scheme gives us **four possibilities: quantity leadership, price leadership, simultaneous quantity setting, and simultaneous price setting**. Each of these types of interaction gives rise to a different set of strategic issues.

- There is also another possible form of interaction that we will examine. **Instead of the firms competing against each other in one form or another they may be able to collude**. In this case the two firms can jointly agree to set prices and quantities that maximize the sum of their profits. This sort of collusion is called a cooperative game.

Quantity leadership

- In the case of quantity leadership, one firm makes a choice before the other firm. **This is called the Stackelberg model** in honor of the first economist who systematically studied leader-follower interactions.

- The Stackelberg model is often used to describe industries in which there is a dominant firm, or a natural leader. For example, IBM is often considered to be a dominant firm in the computer industry. A commonly observed pattern of behavior is for smaller firms in the computer industry to wait for IBM's announcements of new products and then adjust their own product decisions accordingly.

- Suppose that firm 1 is the leader and that it chooses to produce a quantity y_1. Firm 2 responds by choosing a quantity y_2. Each firm knows that the equilibrium price in the market depends on the total output produced. The inverse demand function $p(Y)$ is used to indicate the equilibrium price as a function of industry output, $Y = y_1 + y_2$.

- The leader should choose an output that maximizes his profits. He should expect that the follower will attempt to maximize profits as well, given the choice made by the leader. In order for the leader to make a sensible decision about its own production, **it has to consider the follower's profit-maximization problem.**

Follower's problem

- We assume that the follower wants to maximize its profits

$$\text{Max}_{y2} \; p(y_1 + y_2)y_2 - c_2(y_2)$$

- The follower's profit depends on the output choice of the leader, but from the viewpoint of the follower the leader's output is predetermined—the production by the leader has already been made, and the follower simply views it as a constant.

- The follower wants to choose an output level such that marginal revenue equals marginal cost:

$$MR_2 = p(y_1 + y_2) + \underline{\Delta p} \, y_2 = MC_2.$$
$$\Delta y_2$$

- When the follower increases its output, it increases its revenue by selling more output at the market price. But it also pushes the price down by Δp, and this lowers its profits on all the units that were previously sold at the higher price.

- The important thing to observe is that the profit-maximizing choice of the follower will depend on the choice made by the leader. We write this relationship as $y_2 = f_2(y_1)$.

- **The function $f_2(y_1)$ tells us the profit-maximizing output of the follower as a function of the leader's choice. This function is called the reaction function** since it tells us how the follower will react to the leader's choice of output.

- Let's derive a reaction curve in the simple case of linear demand. In this case the (inverse) demand function takes the form $p(y_1+y_2) = a−b(y_1+y_2)$ For convenience we'll take costs to be zero.

- Then the profit function for firm 2 is

$$\pi_2(y_1, y_2) = [a − b(y_1 + y_2)]y_2$$
$$\mathbf{\pi_2(y_1, y_2) = ay_2 − by_1y_2 − by_2{}^2}$$

- We can use this expression to draw the isoprofit curves. **These are curves depicting those combinations of y_1 and y_2 that yield a constant level of profit to firm 2**. That is, the isoprofit curves are comprised of all points (y_1, y_2) that satisfy equations of the form

$$\mathbf{ay_2 − by_1y_2 − by_2{}^2 = \pi_2(constant)}$$

- Note that profits to firm 2 will increase as we move to isoprofit curves that are further to the left. This is true since if we fix the output of firm 2 at some level, firm 2's profits will increase as firm 1's output decreases. Firm 2 will make its maximum possible profits when it is a monopolist; that is, when firm 1 chooses to produce zero units of output.

Isoprofit curves
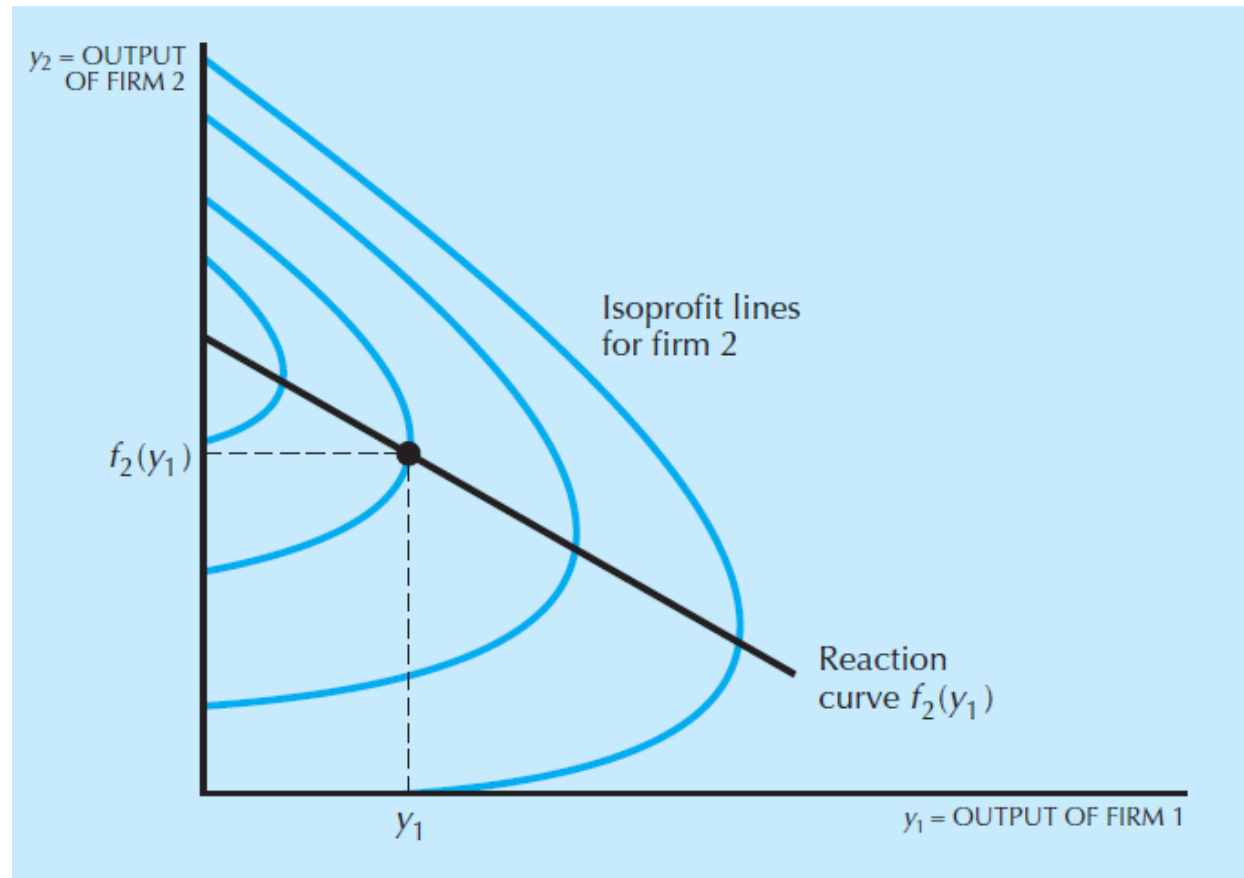
- For each possible choice of firm 1's output, firm 2 wants to choose its own output to make its profits as large as possible. This means that for each choice of y_1, firm 2 will pick the value of y_2 that puts it on the isoprofit line furthest to the left.

- This point will satisfy the usual sort of tangency condition: the slope of the isoprofit curve must be vertical at the optimal choice. **The locus of these tangencies describes firm 2's reaction curve, $f_2(y_1)$.**

- To see this result algebraically, we need an expression for the marginal revenue associated with the profit function for firm 2.

$$MR_2(y_1, y_2) = a - by_1 - 2by_2$$

- Setting marginal revenue equal to marginal cost(which is assumed to be zero), we get

$$a - by_1 - 2by_2 = 0,$$

which we can solve to derive firm 2's reaction curve:

$$y_2 = \frac{a - by_1}{2b}$$

Leader's problem

- We turn now to the leader's profit-maximization problem. Presumably, the leader is also aware that its actions influence the output choice of the follower. This relationship is summarized by the reaction function $f_2(y_1)$. Hence when making its output choice it should recognize the influence that it exerts on the follower.

- The profit-maximization problem for the leader therefore becomes

$$\text{Max}_{y_1}\ p(y_1 + y_2)y_1 - c_1(y_1)$$

$$\text{such that } y_2 = f_2(y_1).$$

- Substituting the second equation into the first gives us

$$\text{Max}_{y_1}\ p[y_1 + f_2(y_1)]y_1 - c_1(y_1)$$

- Note that the leader recognizes that when it chooses output y_1, the total output produced will be $y_1 + f_2(y_1)$: its own output plus the output produced by the follower.

- When the leader contemplates changing its output it has to recognize the influence it exerts on the follower.

- In the context of the linear demand curve, the leader's profits are

$$\pi_1(y_1, y_2) = p(y_1 + y_2)y_1 = ay_1 - by_1^2 - by_1y_2$$

- But the output of the follower, y_2, will depend on the leader's choice via the reaction function $y_2 = f_2(y_1) = \dfrac{a - by_1}{2b}$

- Substituting the reaction function in the profit equation and simplifying the expression, we get

$$\pi_1(y_1, y_2) = \frac{a\ y_1}{2} - \frac{b\ y_1^2}{2}$$

- The marginal revenue for this function is
$$MR = \frac{a}{2} - by_1.$$
- Setting this equal to marginal cost, which is zero in this example, and solving for y_1 gives us
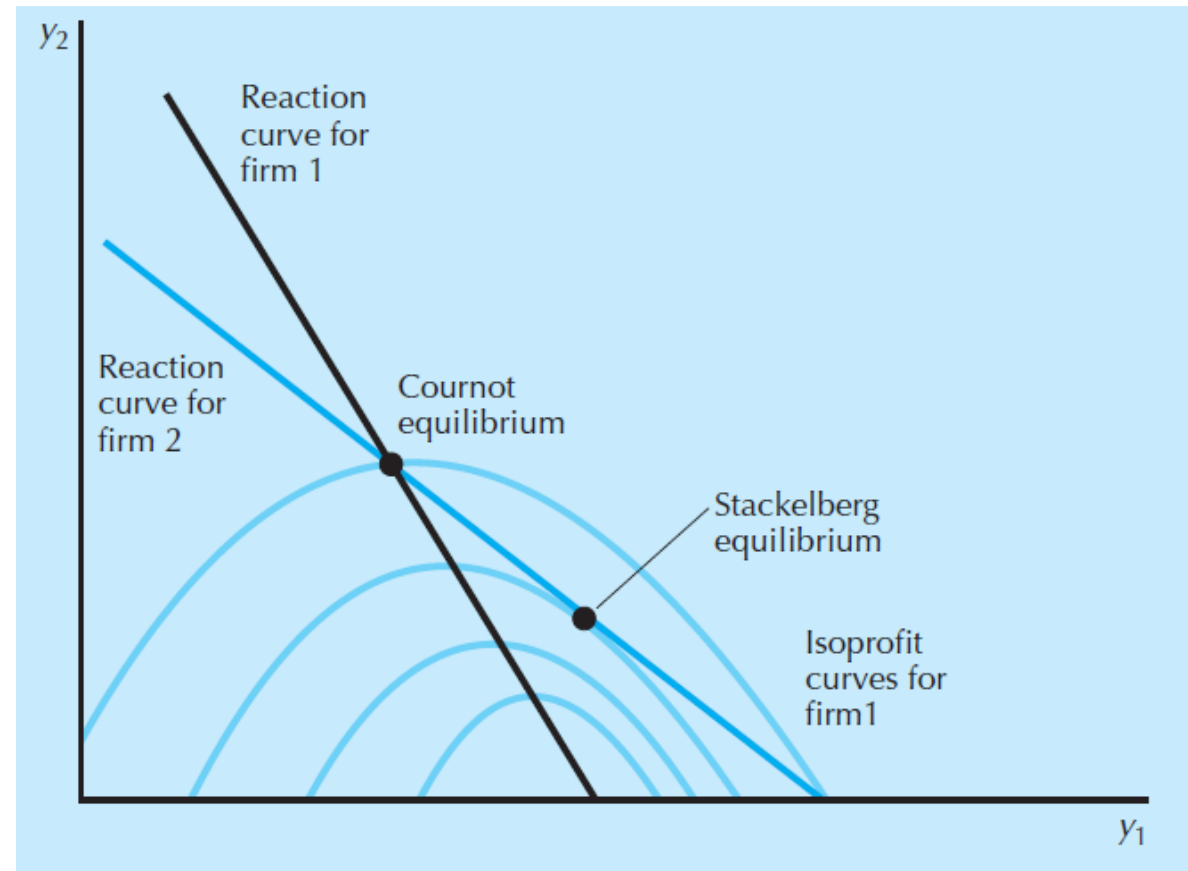$$\mathbf{y_1^* = a/2b}$$

- In order to find the follower's output, we simply substitute $y*_1$ into the reaction function,
$$y_2^* = \frac{a - by_1^*}{2b}$$
$$\mathbf{y_2^* = a/4b}$$
- These two equations give a total industry output of $\mathbf{y*_1 + y*_2 = 3a/4b.}$

Stackelberg equillibrium

- The isoprofit curves for firm 1 have the same general shape as the isoprofit curves for firm 2; they are simply rotated 90 degrees. Higher profits for firm 1 are associated with isoprofit curves that are lower down since firm 1's profits will increase as firm 2's output decreases.

- Firm 2 is behaving as a follower, which means that it will choose an output along its reaction curve, $f_2(y_1)$. **Thus firm 1 wants to choose an output combination on the reaction curve that gives it the highest possible profits**. But the highest possible profits means picking that point on the reaction curve that touches the lowest isoprofit curve.

Price Leadership

- Instead of setting quantity, the leader may instead set price. In order to make a sensible decision about how to set its price, the leader must forecast how the follower will behave. Accordingly, we must first investigate the profit-maximization problem facing the follower.

- The first thing we observe is that **in equilibrium the follower must always set the same price as the leader**. This follows from our assumption that the two firms are selling identical products. If one charged a different price from the other, all of the consumers would prefer the producer with the lower price, and we couldn't have an equilibrium with both firms producing.

- Suppose that the leader has set a price p. We will suppose that the follower takes this price as given and chooses its profit-maximizing output. This is essentially the same as the competitive behavior. In the competitive model, each firm takes the price as being outside of its control because it is such a small part of the market; in the price leadership model, the follower takes the price as being outside of its control since it has already been set by the leader.

- The follower wants to maximize profits:

$$\text{Max}_{y2} \; py_2 - c_2(y_2)$$

- This leads to the familiar condition that the follower will want to choose an output level where price equals marginal cost. This determines a supply curve for the follower, $S(p)$.

- Turn now to the problem facing the leader. It realizes that if it sets a price p, the follower will supply $S(p)$. That means that the amount of output the leader will sell will be $R(p) = D(p) - S(p)$. **This is called the residual demand curve facing the leader**.

- Suppose that the leader has a constant marginal cost of production c. Then the profits that it achieves for any price p are given by:

$$\pi_1(p) = (p - c)[D(p) - S(p)] = (p - c)R(p)$$

- In order to maximize profits the leader wants to choose a price and output combination where marginal revenue equals marginal cost. **However, the marginal revenue should be the marginal revenue for the residual demand curve**—the curve that actually measures how much output it will be able to sell at each given price.

Price leader
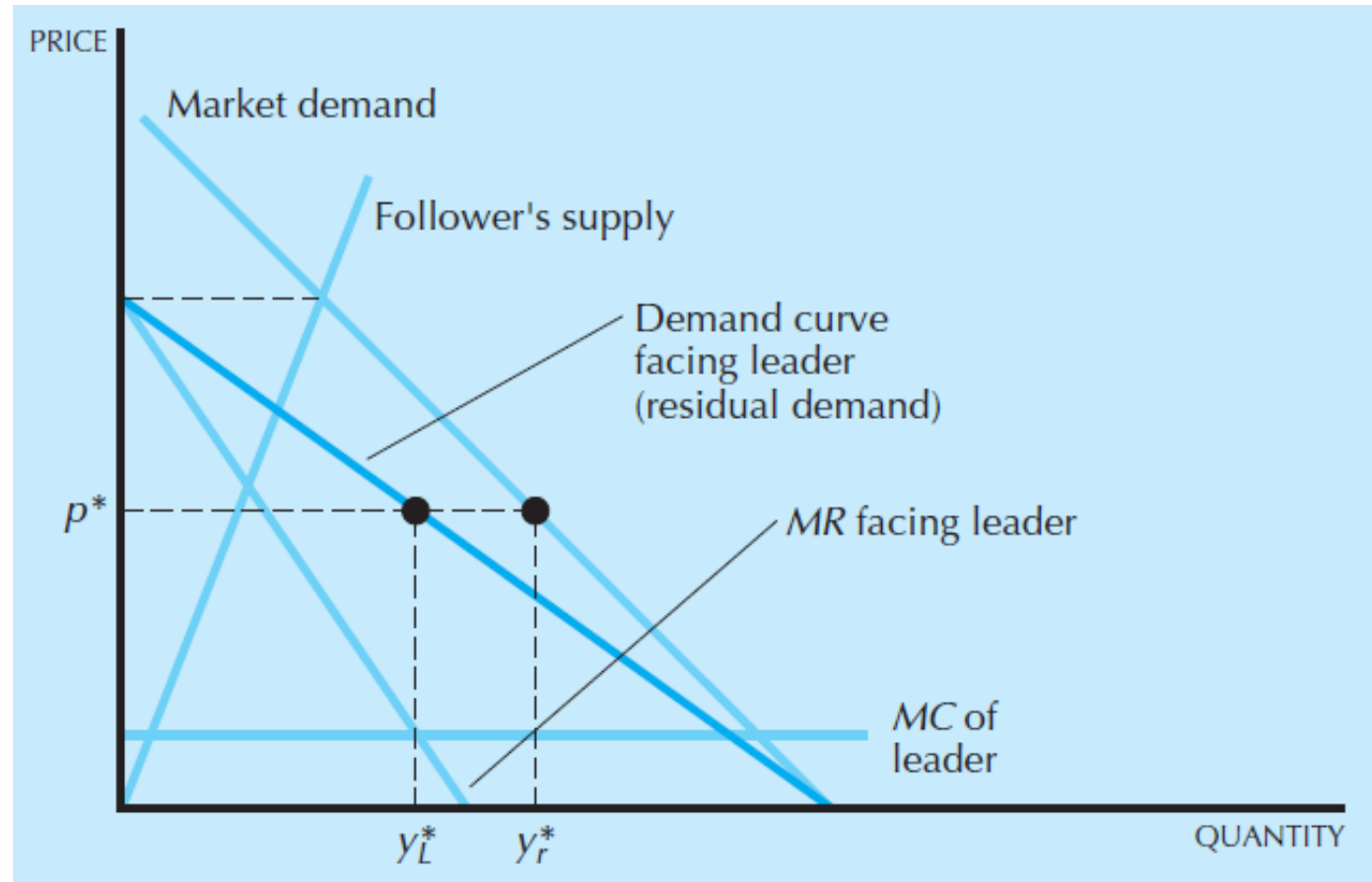
Advantages of price leadership

- If companies in a particular market follow a price leader by setting higher prices, then all producers in that market stand to profit, as long as demand remains steady.

- Price leadership has the potential to eliminate (or reduce) price wars. If a market is completely comprised of companies of a similar size, in the absence of price leadership, price wars could ensue as each competitor tries to increase its share of the market.

- One side effect of price leadership may be better-quality products as a result of an increase in profits. Increased profits often mean more revenue for companies to invest in research and development (R&D), and thus, an increase in their ability to design new products and deliver more value to customers.

Disadvantages of price leadership

- There are also many potential disadvantages to the emergence of price leadership within an industry. In general, price leadership is only advantageous to businesses (in terms of their profits and performance). Price leadership where prices are increased does not convey any material advantages to consumers.

- Price leadership can also be unfair to smaller firms because small firms who attempt to match a leader's prices may not have the same economies of scale as the leaders. This can make it hard for them to sustain consistent price declines.

Comparing price leadership and quantity leadership

- Each model determines a different equilibrium price and output combination; each model is appropriate in different circumstances.

- One way to think about quantity setting is to think of the firm as making a capacity choice. When a firm sets a quantity it is in effect determining how much it is able to supply to the market. If one firm is able to make an investment in capacity first, then it is naturally modeled as a quantity leader.

- On the other hand, suppose that we look at a market where capacity choices are not important but one of the firms distributes a catalog of prices. It is natural to think of this firm as a price setter. Its rivals may then take the catalog price as given and make their own pricing and supply decision accordingly.

- Whether the price-leadership or the quantity-leadership model is appropriate is not a question that can be answered on the basis of pure theory. We have to look at how the firms actually make their decisions in order to choose the most appropriate model.

Simultaneous quantity setting

- One difficulty with the leader-follower model is that it is necessarily asymmetric: one firm is able to make its decision before the other firm. In some situations this is unreasonable. For example, suppose that two firms are simultaneously trying to decide what quantity to produce. Here each firm has to forecast what the other firm's output will be in order to make a sensible decision itself.

- We will examine a one-period model in which each firm has to forecast the other firm's output choice. Given its forecast, each firm then chooses a profit-maximizing output for itself. We then seek an equilibrium in forecasts—a situation where each firm finds its beliefs about the other firm to be confirmed. **This model is known as the Cournot model**, after the nineteenth-century French mathematician who first examined its implications.

- We begin by assuming that firm 1 expects that firm 2 will produce y_2^e units of output. (e stands for expected output.) If firm 1 decides to produce y_1 units of output, it expects that the total output produced will be $Y = y_1 + y_2^e$, and output will yield a market price of $p(Y) = p(y_1 + y_2^e)$

- The profit-maximization problem of firm 1 is then

$$\max_{y_1} p(y_1 + y_2^e)y_1 - c(y_1)$$

- For any given belief about the output of firm 2, y_2^e, there will be some optimal choice of output for firm 1, y_1. Let us write this functional relationship between the expected output of firm 2 and the optimal choice of firm 1 as $\mathbf{y_1 = f_1(y_2^e)}$. This function is simply the reaction function (here function of the firm's beliefs about the other firm's choice)

- Similarly, we can derive firm 2's reaction curve:

$$y_2 = f_2(y_1^e),$$

which gives firm 2's optimal choice of output for a given expectation about firm 1's output, y_1^e.

- Recall that each firm is choosing its output level assuming that the other firm's output will be at y_1^e or y_2^e. For arbitrary values of y_1^e and y_2^e this won't happen—in general firm 1's optimal level of output, y_1, will be different from what firm 2 expects the output to be, y_1^e.

- Let us seek an output combination $(y*_1, y*_2)$ such that the optimal output level for firm 1, assuming firm 2 produces $y*_2$ is $y*_1$ and the optimal output level for firm 2, assuming that firm 1 stays at $y*_1$, is $y*_2$. In other words, the output choices $(y*_1, y*_2)$ satisfy

$$y*_1 = f_{1(}y*_2)$$
$$y*_2 = f_2(y*_1)$$

- Such a combination of output levels is known as a Cournot equilibrium. In a Cournot equilibrium, each firm is maximizing its profits, given its beliefs about the other firm's output choice, and, furthermore, those beliefs are confirmed in equilibrium: each firm optimally chooses to produce the amount of output that the other firm expects it to produce.

- **In a Cournot equilibrium neither firm will find it profitable to change its output once it discovers the choice actually made by the other firm**.

- The Cournot equilibrium is simply the pair of outputs at which the two reaction curves cross. At such a point, each firm is producing a profit-maximizing level of output given the output choice of the other firm.

Cournot Equillibrium

Cournot-Nash Equillibrium
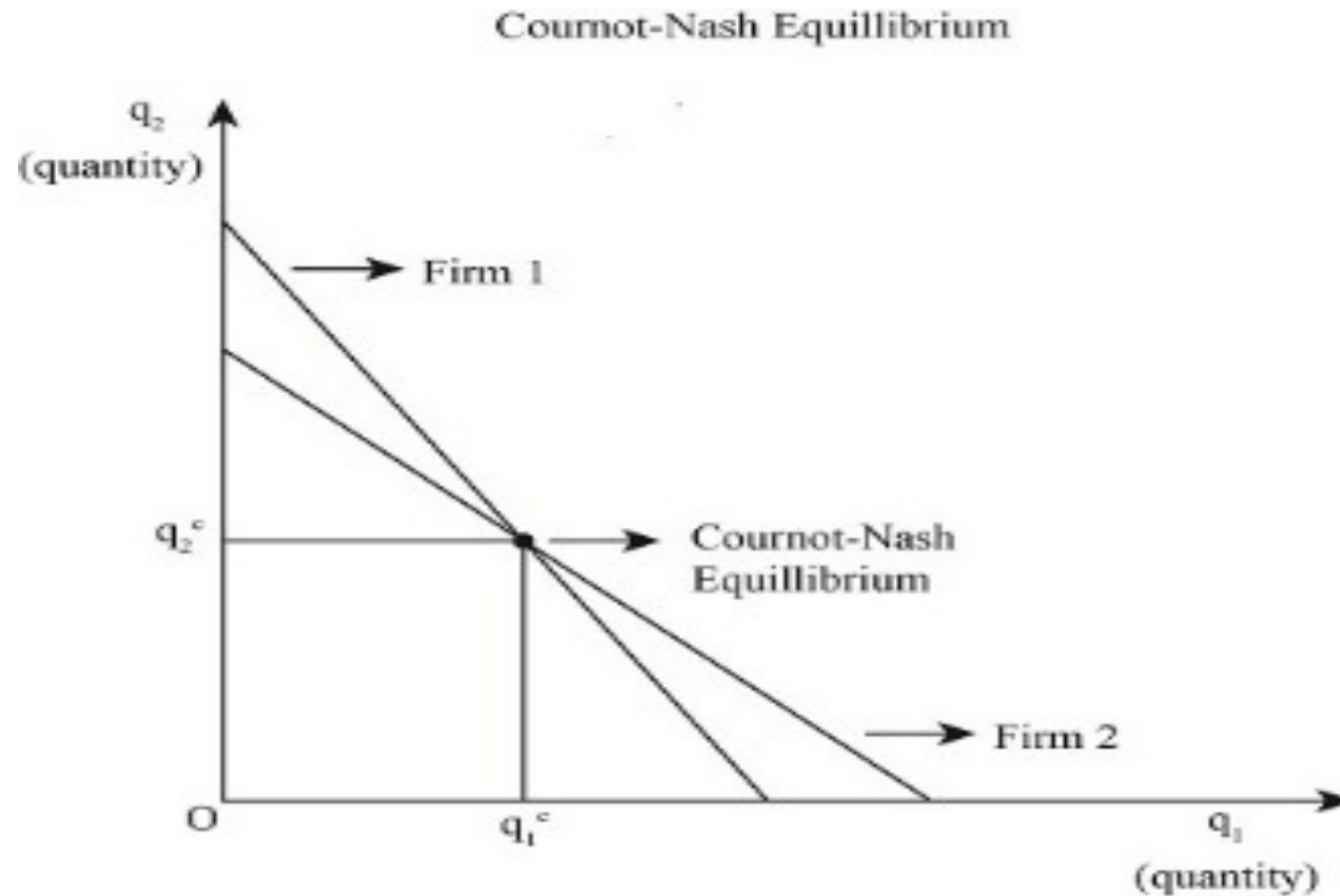
- Recall the case of the linear demand function and zero marginal costs that we saw earlier. We saw that in this case the reaction function for firm 2 took the form

$$y_2 = \frac{a - by_1^e}{2b}$$

- Since here firm 1 is exactly the same as firm 2, its reaction curve has the same form:

$$y_1 = \frac{a - by_2^e}{2b}$$

- The intersection of the two reaction lines gives us the Cournot equilibrium. **At this point each firm's choice is the profit-maximizing choice, given its beliefs about the other firm's behavior, and each firm's beliefs about the other firm's behaviour are confirmed by its actual behaviour.**

- In order to calculate the Cournot equilibrium algebraically, we look for the point (y_1, y_2) where each firm is doing what the other firm expects it to do. We set $y_1 = y_1^e$ and $y_2 = y_2^e$ which gives us the following two equations in two unknowns:

$$y_1 = \frac{a - by_2^e}{2b}$$

$$y_2 = \frac{a - by_1^e}{2b}$$

- In this example, both firms are identical, so each will produce the same level of output in equilibrium. Hence we can substitute $y_1 = y_2$ into one of the above equations to get

$$y_1 = \frac{a - by_1^e}{2b}$$

Solving for y_1^* we get $y_1^* = a/3b$.

- Since the two firms are identical, this implies that $y_2^* = a/3b$. as well. Hence the **total industry output is 2a/3b.**

Simultaneous price setting

- In the Cournot model, we have assumed that firms were choosing their quantities and letting the market determine the price. Another approach is to think of firms as setting their prices and letting the market determine the quantity sold. This model is known as **Bertrand competition**.

- When a firm chooses its price, it has to forecast the price set by the other firm in the industry. Just as in the case of Cournot equilibrium we want to find a pair of prices such that each price is a profit-maximizing choice given the choice made by the other firm.

- When firms are selling identical products, as we have been assuming, the Bertrand equilibrium has a very simple structure indeed. **It turns out to be the competitive equilibrium, where price equals marginal cost.**

- First we note that price can never be less than marginal cost since then either firm would increase its profits by producing less. So let us consider the case where price is greater than marginal cost.

- Suppose that both firms are selling output at some price $\hat{p}$ greater than marginal cost. Consider the position of firm 1. If it lowers its price by any small amount ϱ and if the other firm keeps its price fixed at $\hat{p}$, all of the consumers will prefer to purchase from firm 1. By cutting its price by an arbitrarily small amount, it can steal all of the customers from firm 2.

- If firm 1 really believes that firm 2 will charge a price $\hat{p}$ that is greater than marginal cost, it will always pay firm 1 to cut its price to $\hat{p} - \varrho$. But firm 2 can reason the same way.

- Thus any price higher than marginal cost cannot be an equilibrium; the only equilibrium is the competitive equilibrium.

Collusion

- In the models we have examined up until now the firms have operated independently. But if the firms collude so as to jointly determine their output, these models are not very reasonable. If collusion is possible, the firms would do better to choose the output that maximizes total industry profits and then divide up the profits among themselves.

- When firms get together and attempt to set prices and outputs so as to maximize total industry profits, they are known as a cartel. A cartel is simply a group of firms that jointly collude to behave like a single monopolist and maximize the sum of their profits.

- Thus the profit-maximization problem facing the two firms is to choose their outputs y_1 and y_2 so as to maximize total industry profits:

$$\max_{y1,y2} \; p(y_1 + y_2)[y_1 + y_2] - c_1(y_1) - c_2(y_2)$$

- This will have the optimality conditions

$$p(y*_1 + y*_2) + \frac{\Delta p}{\Delta Y}[y*_1 + y*_2] = MC_1(y*_1)$$

$$p(y*_1 + y*_2) + \frac{\Delta p}{\Delta Y}[y*_1 + y*_2] = MC_2(y*_2)$$

- When firm 1 considers expanding its output by Δy_1, it will contemplate the usual two effects: the extra profits from selling more output and the reduction in profits from forcing the price down. But in the second effect, it now takes into account the effect of the lower price on both its own output and the output of the other firm. This is because it is now interested in maximizing total industry profits, not just its own profits.

- **The optimality conditions imply that the marginal revenue of an extra unit of output must be the same no matter where it is produced. It follows that $MC_1(y*_1) = MC_2(y*_2)$, so that the two marginal costs will be equal in equilibrium**. If one firm has a cost advantage, so that its marginal cost curve always lies below that of the other firm, then it will necessarily produce more output in equilibrium in the cartel solution.

- We can calculate the cartel solution for the case of zero marginal costs and the linear demand curve we used in the Cournot case. The aggregate profit function will be

$$\pi(y_1, y_2) = [a - b(y_1 + y_2)](y_1 + y_2) = a(y_1 + y_2) - b(y_1 + y_2)^2,$$

 so the marginal revenue equals marginal cost conditions will be

$$a - 2b(y*_1 + y*_2) = 0, \text{ which implies that}$$

$$\mathbf{y*_1 + y*_2 = a/2b}$$

- Since marginal costs are zero, the division of output between the two firms doesn't matter. All that is determined is the total level of industry output.

- The following figure illustrates the isoprofit curves for each of the firms and have highlighted the locus of common tangents.
- Since the cartel is trying to maximize total industry profits, it follows that the marginal profits from having either firm produce more output must be the same—otherwise it would pay to have the more profitable firm produce more output. This in turn implies that the slopes of the isoprofit curves must be the same for each firm; that is, that the isoprofit curves must be tangent to each other.
- Hence **the output combinations that maximize total industry profits—the cartel solution—are those that lie along the line which is the locus of common tangents**.

Two firm cartel
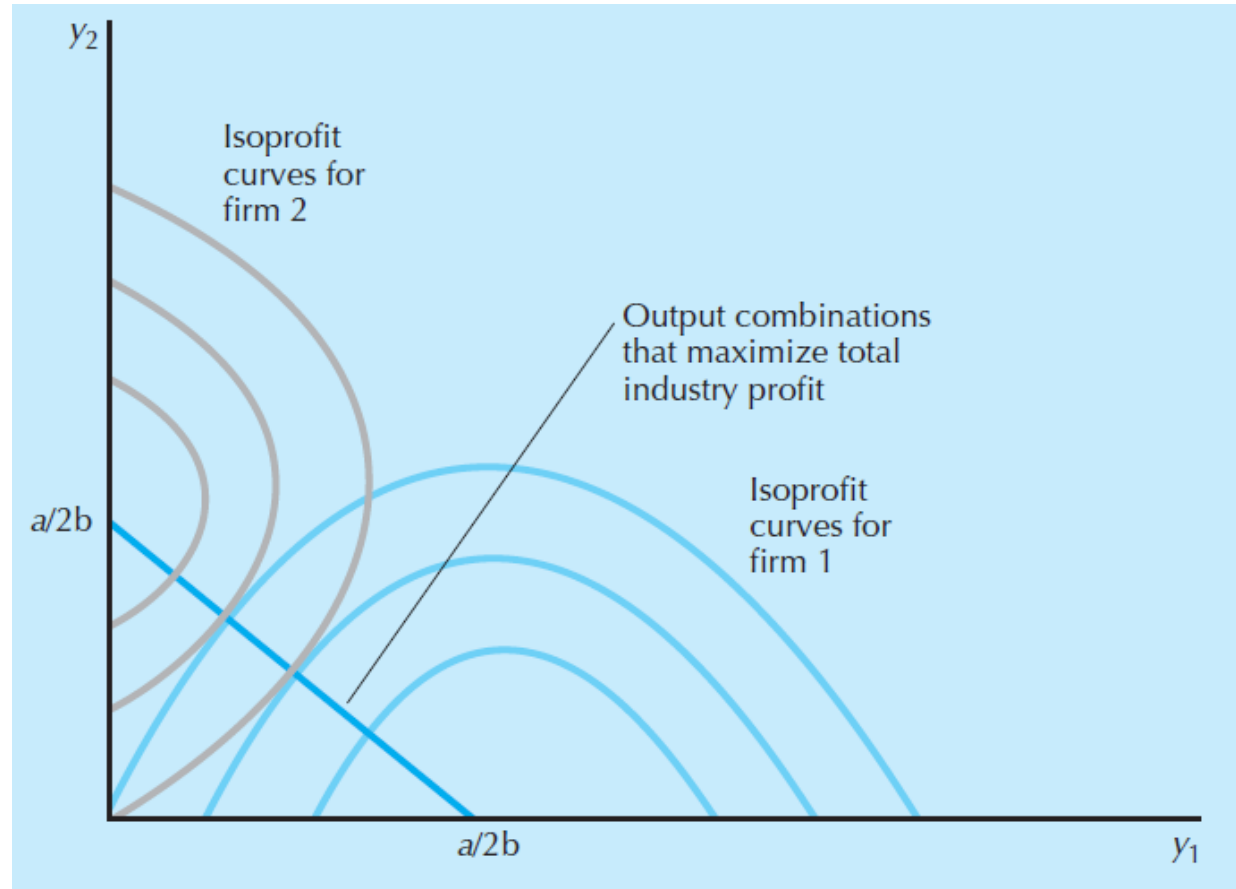
Comparison of solutions

- We have now examined several models of duopoly behavior: quantity leadership (Stackelberg), price leadership, simultaneous quantity setting (Cournot), simultaneous price setting (Bertrand), and the collusive solution. How do they compare?

- In general, collusion results in the smallest industry output and the highest price. Bertrand equilibrium—the competitive equilibrium—gives us the highest output and the lowest price. The other models give results that are in between these two extremes.

- A variety of other models are possible. For example, we could look at a model with differentiated products where the two goods produced were not perfect substitutes for each other. Or we could look at a model where the firms make a sequence of choices over time. In this framework, the choices that one firm makes at one time can influence the choices that the other firm makes later on.

- We have also assumed that each firm knows the demand function and the cost functions of the other firms in the industry. In reality these functions are never known for sure. Each firm needs to estimate the demand and cost conditions facing its rivals when it makes its own decisions.

Public Policies towards Oligopolies

- Cooperation among oligopolists is undesirable from the standpoint of society as a whole, because it leads to production that is too low and prices that are too high. **To move the allocation of resources closer to the social optimum, policymakers should try to induce firms in an oligopoly to compete rather than cooperate**.

- One way that policy discourages cooperation is through the common law. Most commentators agree that price-fixing agreements among competing firms should be illegal. Yet the antitrust laws have been used to condemn some business practices whose effects are not obvious.

- **One example of a controversial business practice is resale price maintenance**, also called fair trade. Imagine that Superduper Electronics sells DVD players to retail stores for $300. If Superduper requires the retailers to charge customers $350, it is said to engage in resale price maintenance.

- At first, resale price maintenance might seem anticompetitive and, therefore, detrimental to society. Like an agreement among members of a cartel, it prevents the retailers from competing on price.

- Yet some economists defend resale price maintenance on two grounds. To the extent that Superduper Electronics has any market power, it can exert that power through the wholesale price, rather than through resale price maintenance. Moreover, Superduper has no incentive to discourage competition among its retailers. Indeed, because a cartel of retailers sells less than a group of competitive retailers, Superduper would be worse off if its retailers were a cartel.

- Second, economists believe that resale price maintenance has a legitimate goal. Superduper may want its retailers to provide customers a pleasant showroom and a knowledgeable sales force. Yet, without resale price maintenance, some customers would take advantage of one store's service to learn about the DVD player's special features and then buy the item at a discount retailer that does not provide this service.

- Business practices that appear to reduce competition may in fact have legitimate purposes. This principle makes the application of the antitrust laws all the more difficult

Predatory pricing

- The second example of a controversial business practice relates to predatory pricing.

- Firms with market power normally use that power to raise prices above the competitive level. But should policymakers ever be concerned that firms with market power might charge prices that are too low? This question is at the heart of a second debate over antitrust policy.

- Although predatory pricing is a common claim in antitrust suits, some economists are skeptical of this argument and believe that predatory pricing is rarely, and perhaps never, a profitable business strategy. Why? For a price war to drive out a rival, prices have to be driven below cost.