

Lesson 3 - Supply & Demand

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Section 1 - Demand

The Law of Demand

Teach a parrot the terms of 'supply and demand'
and you've got an economist.

Thomas Carlyle

A market brings together and facilitates trade between buyers and sellers of goods or services. These markets range from bartering in street markets to trades that are made through the internet with individuals, around the world, that never have met face to face.

A market consists of those individuals who are willing and able to purchase the particular good and sellers who are willing and able to supply the good. The market brings together those who demand and supply the good to determine the price.

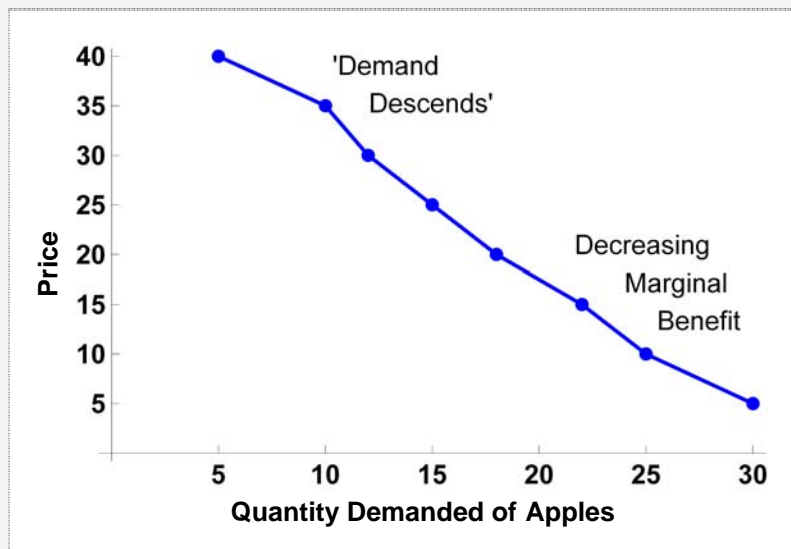
For example, the number of many apples an individual would be willing and able to buy each month depends in part on the price of apples. Assuming only price changes, then at lower prices, a consumer is willing and able to buy more apples. As the price rises (again holding all else constant), the quantity of apples demanded decreases. The **Law of Demand** captures this relationship between price and the quantity demanded of a product. It states that there is an inverse (or negative) relationship between the price of a good and the quantity demanded.

Downward Sloping Demand for Apples

As the price of apples increase, the quantity demanded decreases. This is because consumers demand less at a higher price. As the price of apples decreases, the quantity demanded increases since consumers demand more at a lower price. This is the law of demand.

Table for Demand

Price	No. of Apples
5	30
10	25
15	22
20	18
25	15
30	12
35	10
40	5



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Demand Curve

Recall, that we represent economic laws and theory using models; in this case we can use a **demand schedule** or a **demand curve** to illustrate the Law of Demand. The **demand schedule** shows the combinations of price and quantity demanded of apples in a table format. The graphical representation of the demand schedule is called the **demand curve**.

When graphing the demand curve, price goes on the vertical axis and quantity demanded goes on the horizontal axis. A helpful hint when labeling the axes is to remember that since P is a tall letter, it goes on the vertical axis. Another hint when graphing the demand curve is to remember that demand descends.

The demand curve reflects our marginal benefit and thus our willingness to pay for additional amounts of a good. It makes sense that our marginal benefit, or willingness to pay for a good, would decline as we consume additional units because we get less additional satisfaction from each successive unit consumed. For example, at lunch time you decide to buy pizza by-the-piece. You'd be willing to pay a lot for that first piece to satisfy your hunger. But what about the second piece? Perhaps a little less. If we keep considering each additional piece, we might ask what the 3rd, 4th or 5th piece is worth to you. By that point, you'd be willing to pay less, perhaps much less. The law of demand and our models illustrate this behavior.

A more formal examination of the law of demand shows the most basic reasons for the downward sloping nature of demand. The first is the **substitution effect** which states that as the price of the good declines, it becomes relatively less expensive compared to the price of other goods, and thus the quantity demanded is greater at a lower price. When the price of the good rises, the opposite occurs; that is, as the price of the good becomes relatively more expensive compared to other goods a lower quantity will be demanded. For example, as the price of apples increases or decreases, apples become relatively more or less expensive compared to other goods, such as oranges. Thus if the price of apples declines, consumers will buy more apples since they are relatively less expensive compared to other goods, such as oranges.

The second factor is the **income effect** which states that as the price of a good decreases, consumers become relatively richer. Now, their incomes have not increased, but their buying power has increased due to the lower price.

If they continued to buy the same amount, they would have some money left over - some of that extra money could be spent on the good that has the lower price, that is quantity demanded would increase. On the other hand, as the price of a good increases, then the buying power of individuals decreases and the quantity demanded decreases. For example, at 20 cents per apple, we are able to purchase 5 apples for \$1 but if the price falls to 10 cents, we would be able to buy 10 apples for \$1. Although our income has not changed, we have become relatively richer.

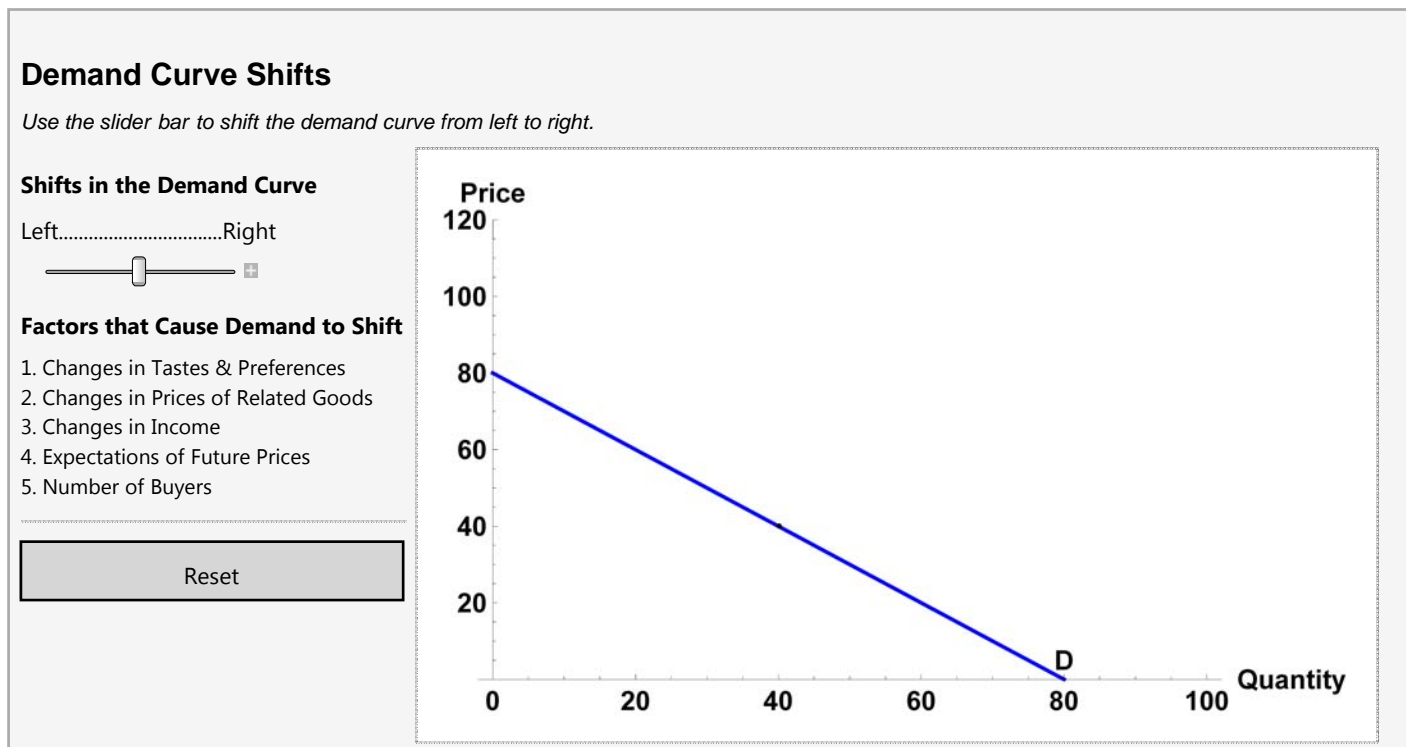
At this point, we have explained why there is an inverse relationship between price and quantity demanded (i.e. we've explained the law of demand). The changes in price that we have discussed cause movements along the demand curve, called changes in quantity demanded. But there are factors other than price that cause complete shifts in the demand curve which are called changes in demand (Note that these new factors also determine the actual placement of the demand curve on a graph).

While a change in the price of the good moves us along the demand curve to a different quantity demanded, a change or shift in demand will cause a different quantity demanded at each and every price. A rightward shift in demand would increase the quantity demanded at all prices compared to the original demand curve. For example, at a price of \$40, the quantity demanded would increase from 40 units to 60 units. A helpful hint to remember that more demand shifts the demand curve to the right. Move the slider on the graph below to see the rightward shift.

A leftward shift in demand would decrease the quantity demanded to 20 units at the price of \$40. With a decrease in demand, there is a lower quantity demanded at each an every price along the demand curve. Move the slider on the graph below to see the leftward shift.

Factors that Shift the Demand Curve

The factors listed below will shift the demand curve either to the right or to the left.



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1. Change in Tastes and Preferences

A change in tastes and preferences will cause the demand curve to shift either to the right or left. For example, if new research found that eating apples increases life expectancy and reduces illness, then more apples would be pur-

chased at each and every price causing the demand curve to shift to the right. Companies spend billions of dollars in advertising to try and change individuals' tastes and preferences for a product. Celebrities or sports stars are often hired to endorse a product to increase the demand for a product. A leftward shift in demand is caused by a factor that adversely affects the tastes and preferences for the good. For example, if a pesticide used on apples is shown to have adverse health effects.

2. Changes in Prices of Related Goods

Another factor that determines the demand for a good is the price of related goods. These can be broken down into two categories – **substitutes** and **complements**. A **substitute** is something that takes the place of the good. Instead of buying an apple, one could buy an orange. If the price of oranges goes up, we would expect an increase in demand for apples since consumers would move consumption away from the higher priced oranges towards apples which might be considered a substitute good. **Complements**, on the other hand, are goods that are consumed together, such as caramels and apples. If the price for a good increases, its quantity demanded will decrease and the demand for the complements of that good will also decline. For example, if the price of hot dogs increases, one will buy fewer hot dogs and therefore demand fewer hot dog buns, which are complements to hot dogs.

3. Changes in Income

Remember that demand is made up of those who are willing and able to purchase the good at a particular price. Income influences both willingness and ability to pay. As one's income increases, a person's ability to purchase a good increases, but she/he may not necessarily want more. If the demand for the good increases as income rises, the good is considered to be a **normal good**. Most goods fall into this category; we want more cars, more TVs, more boats as our income increases. As our income falls, we also demand fewer of these goods. **Inferior goods** have an inverse relationship with income. As income rises we demand fewer of these goods, but as income falls we demand more of these goods. Although individual preferences influence if a good is normal or inferior, in general, Top Ramen, Mac and Cheese, and used clothing fall into the category of an inferior good.

4. Expectations of the Future

Another factor of demand is future expectations. This includes expectations of future prices and income. An individual that is graduating at the end of the semester, who has just accepted a well paying job, may spend more today given the expectation of a higher future income. This is especially true if the job offer is for more income than what he had originally anticipated. If one expects the price of apples to go up next week, she will likely buy more apples today while the price is still low.

5. Number of Buyers

The last factor of demand is the number of buyers. A competitive market is made up of many buyers and many sellers. Thus a producer is not particularly concerned with the demand of one individual but rather the demand of all the buyers collectively in that market. As the number of buyers increases or decreases, the demand for the good will change.

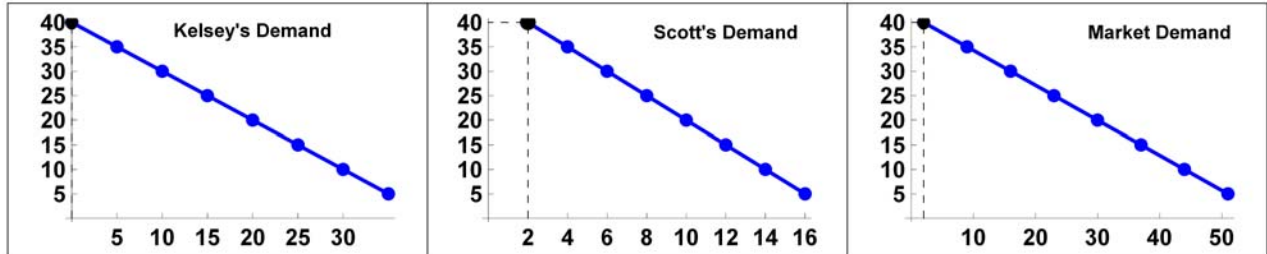
Market Demand

The market demand is determined by the horizontal summation of the individual demands. For example, at 20 cents per apple, Kelsey would buy 20 apples, Scott would buy 10 apples, making the market quantity demanded at 20 cents equal to 30 apples.

When determining the market demand graphically, we select a price then find the quantity demanded by each individual at that price. To determine the entire demand curve, we would then select another price and repeat the process.

Market Demand Curve

Imagine Kelsey and Scott are they only two consumers in a market. Click on each price to see how their quantity demanded changes. Market demand is a horizontal summation of individual demands.



Price

Individual and Market Demand

Price	Kelsey's Quantity Demanded	Scott's Quantity Demanded	Market Quantity Demand
40	0	2	2

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Demand vs. Quantity Demanded

At this point, it is important to re-emphasize that there is an important distinction between **changes in demand** and **changes in quantity demanded**. The entire curve showing the various combinations of price and quantity demanded represents the demand curve. Thus a change in the price of the good does not shift the curve (or change demand) but causes a movement along the demand curve to a different quantity demanded. If the price returned to its original price, we would return to the original quantity demanded.

Demand Curve Shifts vs. Movements Along the Demand Curve

Use the first slider bar to shift the demand curve from left to right, and the second slider bar to change the price of the good.

Shifts in the Demand Curve

Left.....Right



Factors that Cause Demand to Shift

1. Changes in Tastes & Preferences
2. Changes in Prices of Related Goods
3. Changes in Income
4. Expectations of the Future
5. Number of Buyers

Movements along Demand Curve

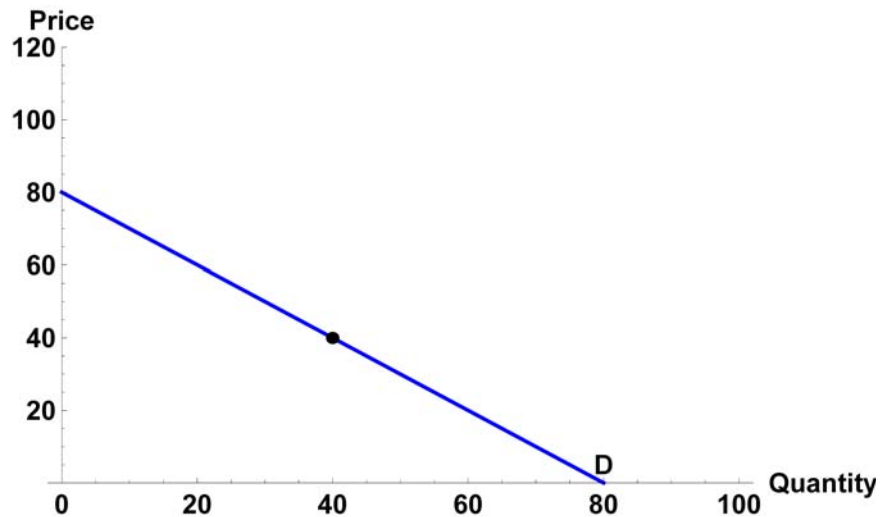
Decrease in Price.....Increase in Price



Price Change = Movement along curve

1. P increases, Qd decreases
1. P decreases, Qd increases

Reset



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If the price were originally \$40, the quantity demanded would be 40 units. An increase in the price of the good to \$60 decreases the quantity demanded to 20 units. This is a movement along the demand curve to a new quantity demanded. Note that if the price were to return to \$40, the quantity demanded would also return to the 40 units. Move the second slider in the graph above to see this movement.

A shift or change in demand comes about when there is a different quantity demanded at each price. At \$40 we originally demanded 40 units. If there is a lower quantity demanded at each price, the demand curve has shifted left. Now at \$40, there are only 20 units demanded. Shift the top or first slider in the graph above to see this shift. Shifts in demand are caused by factors other than the price of the good and, as discussed, include changes in: **1)** tastes and preferences; **2)** price of related goods; **3)** income; **4)** expectations about the future; and **5)** market size.

Ponder and Prove - Section 1 - Law of Demand

Section 1 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

Question 1

Question 2

Question 3

What will happen to the demand of BBQ sauce if technology improvements make it so cows can now be raised and butchered at an accelerated rate, which decreases the price for beef?

- Demand will decrease
- Quantity demanded will decrease
- Quantity demanded will increase
- Demand will increase

Grade My Answer

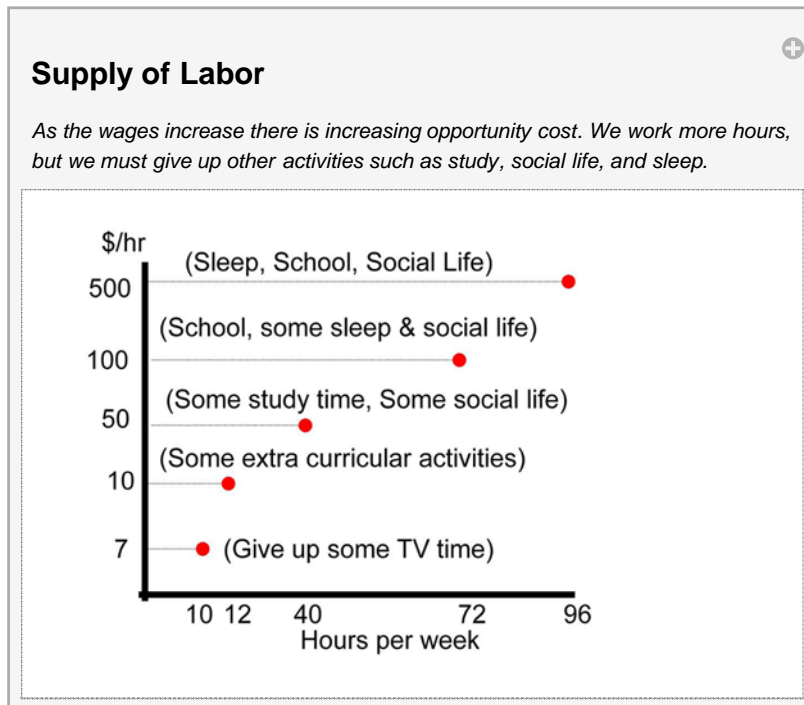
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Section 2 - Supply

The Law of Supply



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If you were offered a job doing data entry this semester and could work as many hours as you wanted, how many hours per week would you work at minimum wage? The answer to this would be based on your opportunity cost. What would you have to give up – social time, study time, or another job? The graph above illustrates the trade-off.

An individual may be willing to work a few hours at a low wage since the value of what they are sacrificing is relatively low. As the wage rate rises, individuals are typically willing to work more hours since the marginal benefit becomes greater than or equal to the marginal cost of what has to be sacrificed. At some point, many students would choose to drop out of school for the semester since the marginal benefit is greater than the marginal cost. Many stars and celebrities never attend college or drop out since the income that they would be foregoing at that time in their lives, exceeds the increase in their earnings potential of attending school. This is an example of the **Law of Supply**. As the wage (or price of labor) increases individuals supply more hours of work, and as the wage decreases individuals supply less hours of work.

Supply Curve

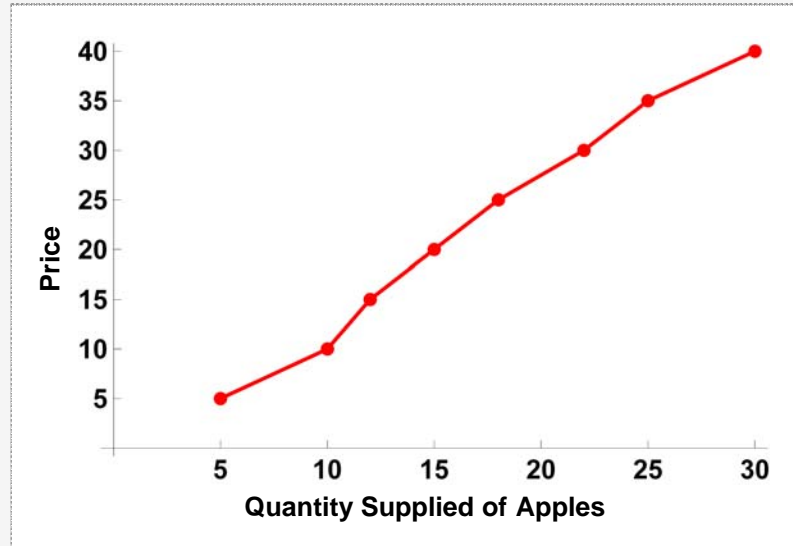
A market consists of those individuals who are willing and able to purchase the particular good and sellers who are willing and able to supply the good. The market brings together those who demand and supply the good to determine the price.

Upward Sloping Supply of Apples

As the price of apples increase, the quantity supplied increases. This is because firms supply more at a higher price. As the price of apples decreases, the quantity supplied decreases since firms supply less at a lower price. This is the law of supply.

Table for Supply

Price	No. of Apples
5	5
10	10
15	12
20	15
25	18
30	22
35	25
40	30



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

In order for individuals to purchase the goods, such as apples, there must be firms that supply those apple to the market. The number of apples a grower would be willing and able to supply each month depends in part on the price of apples. Assuming only price changes, then at lower prices, a grower or firm is willing and able to only supply a few apples. As the price rises (again holding all else constant), the quantity of apples supplied increases. The Law of Supply captures this relationship between price and the quantity demanded of a product. The **supply curve** shows the amount that producers are willing and able to supply to the market at each given price. The supply curve is illustrated in the above graph. Producers must receive a price that covers the marginal cost of production. As the price of the good rises, producers are willing to produce more of the good even though there is an increasing marginal cost.

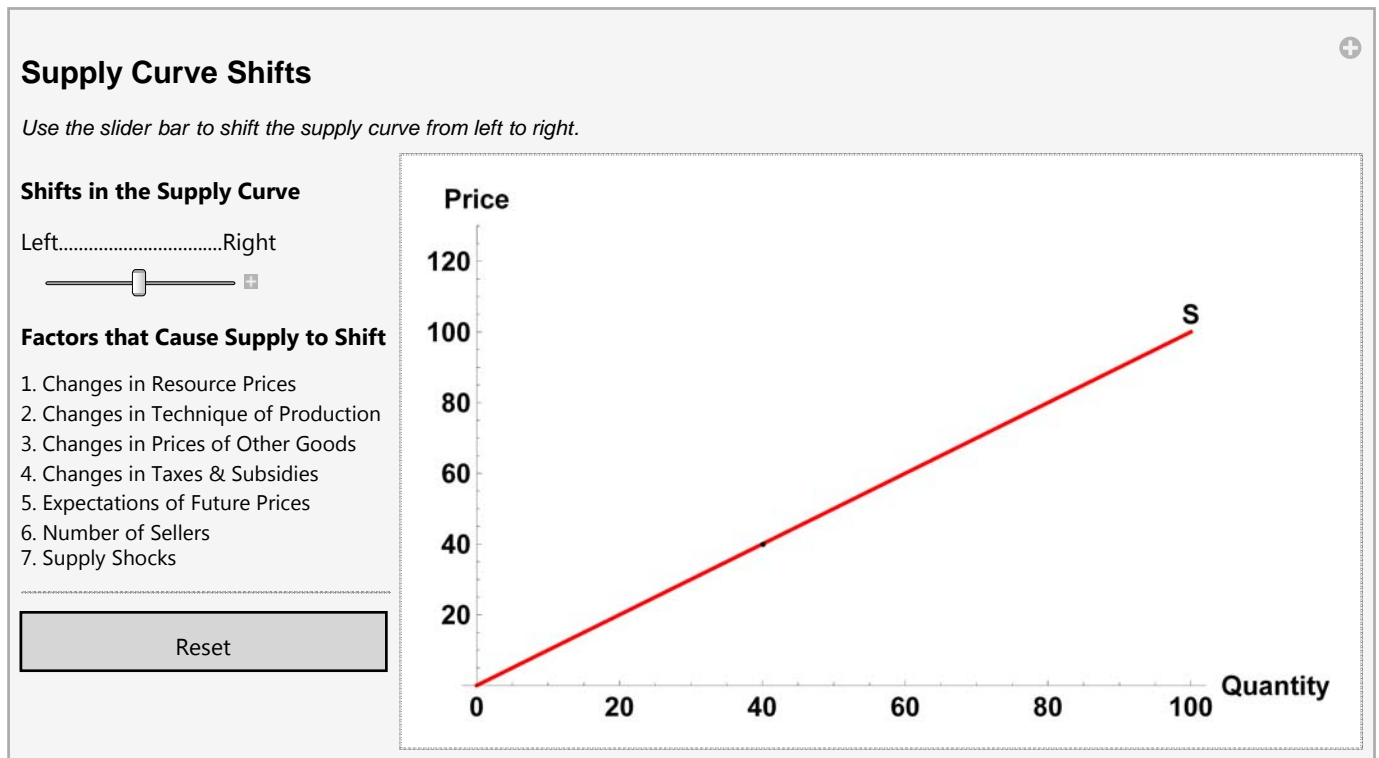
The climate and soils of Idaho allow it to grow some of the best potatoes in the world. At a given price, farmers are willing to supply a certain number of potatoes to the market. Since farmers have already used their land best suited for potato production they have to use land that is less suitable to potato production if they want to grow more potatoes. Since this land is less suited for potato production, yields are lower and the cost per hundredweight of potatoes is greater. As the price of potatoes increases, farmers are able to justify growing more potatoes even though the marginal cost is greater.

Similar to the demand curve, a movement along the supply curve is called a **change in the quantity supplied**. Changes along the supply curve are caused by a change in the price of the good. As the price of the apples increases, producers are willing to supply more apples.

A shift in the supply curve or **change in supply** is caused by a factor other than the price of the good and results in a different quantity supplied at each price.

Factors that Shift the Supply Curve

The factors listed below will shift the supply curve either to the right or to the left.



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

1. Changes in Resource Prices

If the price of crude oil (a resource or input into gasoline production) increases, the quantity supplied of gasoline at each price would decline, shifting the supply curve to the left.

2. Changes in Technique of Production

If a new method or technique of production is developed, the cost of producing each good declines and producers are willing to supply more at each price - shifting the supply curve to the right.

3. Changes in Prices of Other Goods

If the price of wheat increases relative to the price of other crops that could be grown on the same land, such as potatoes or corn, then producers will want to grow more wheat, *ceteris paribus*. By increasing the resources devoted to growing wheat, the supply of other crops will decline. Goods that are produced using similar resources are substitutes in production.

Complements in production are goods that are jointly produced. Beef cows provide not only steaks and hamburger but also leather that is used to make belts and shoes. An increase in the price of steaks will cause an increase in the quantity supplied of steaks and will also cause an increase (or shift right) in the supply of leather which is a complement in production.

4. Changes in Taxes & Subsidies

Taxes and subsidies impact the profitability of producing a good. If businesses have to pay more taxes, the supply curve would shift to the left. On the other hand, if businesses received a subsidy for producing a good, they would be willing to supply more of the good, thus shifting the supply curve to the right.

5. Expectation of Future Prices

Expectations about the future price will shift the supply. If sellers anticipate that home values will decrease in the future, they may choose to put their house on the market today before the price falls. Unfortunately, these expectations often become self-fulfilling prophecies, since if many people think values are going down and put their house on the market today, the increase in supply leads to a lower price.

6. Number of sellers

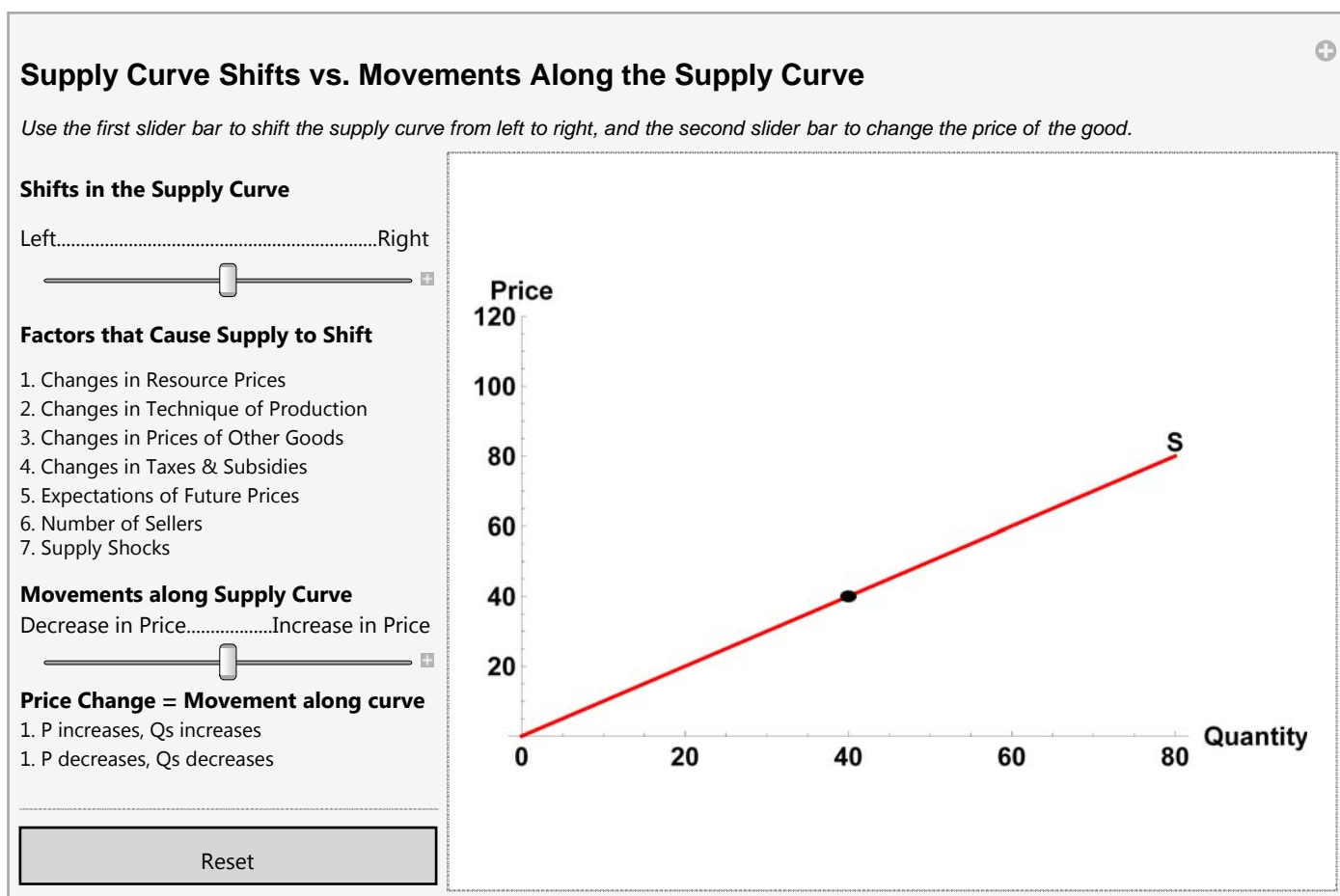
If more companies start to make motorcycles, the supply of motorcycles would increase. If a motorcycle company goes out of business, the supply of motorcycles would decline, shifting the supply curve to the left.

7. Supply Shocks

The last factor is often out of the hands of the producer. Natural disasters such as earthquakes, hurricanes, and floods impact both the production and distribution of goods. While supply shocks are typically negative, there can be beneficial supply shocks with rains coming at the ideal times in a growing season.

Supply vs. Quantity Supplied

To recap, changes in the price of a good will result in movements along the supply curve called changes in quantity supplied. Move the second or bottom slider to see the movements along the supply curve (changes in quantity supplied). A change in any of the other factors we've discussed (and listed below), will shift the supply curve either right or left. The resulting movements are called changes in supply. Move the top or first slider on the graph above to see the curve shift to the right or left.



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Ponder and Prove - Section 2 - Law of Supply

Section 2 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

Question 1 Question 2 Question 3

Which of the following will NOT shift the supply curve to the right?

- Technology improvements increase production
- A tax is increased on the production of the good
- The price of an input decreases
- The price of a substitute in production decreases

Grade My Answer Reset

"Results"

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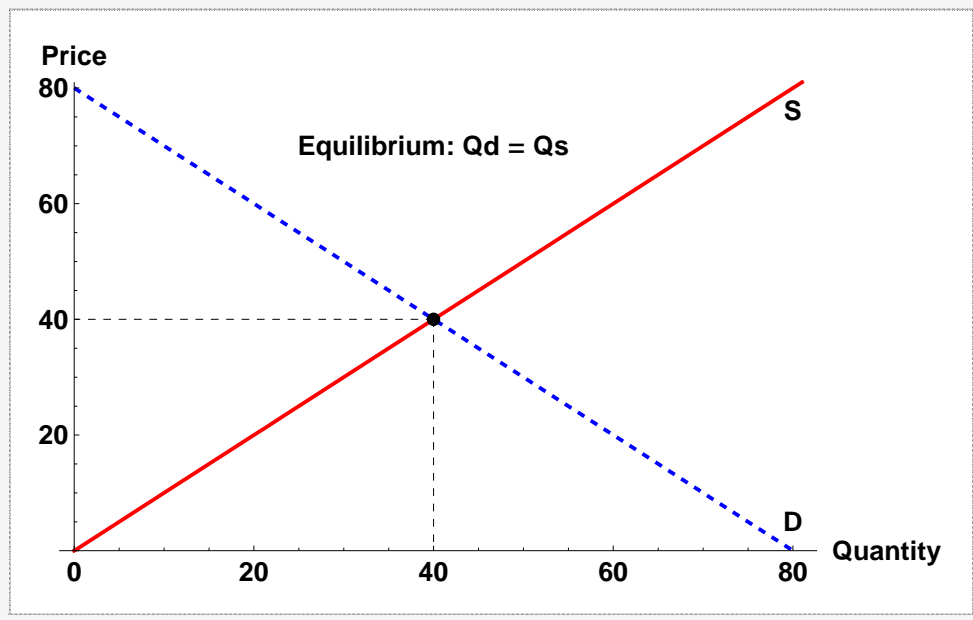
Section 3: Equilibrium

Market Equilibrium

A market brings together those who are willing and able to supply the good and those who are willing and able to purchase the good. In a competitive market, where there are many buyers and sellers, the price of the good serves as a rationing mechanism. Since the demand curve shows the quantity demanded at each price and the supply curve shows the quantity supplied, the point at which the supply curve and demand curve intersect is the point at which the quantity supplied equals the quantity demanded. This is called the **market equilibrium**. In the graph above it is where the price is \$40 and the quantity is 40.

Market Equilibrium

Where the supply (S) and demand (D) curves intersect is the equilibrium price and quantity. At this point $Q_d = Q_s$. The price acts as a rationing tool to bring the market to equilibrium.



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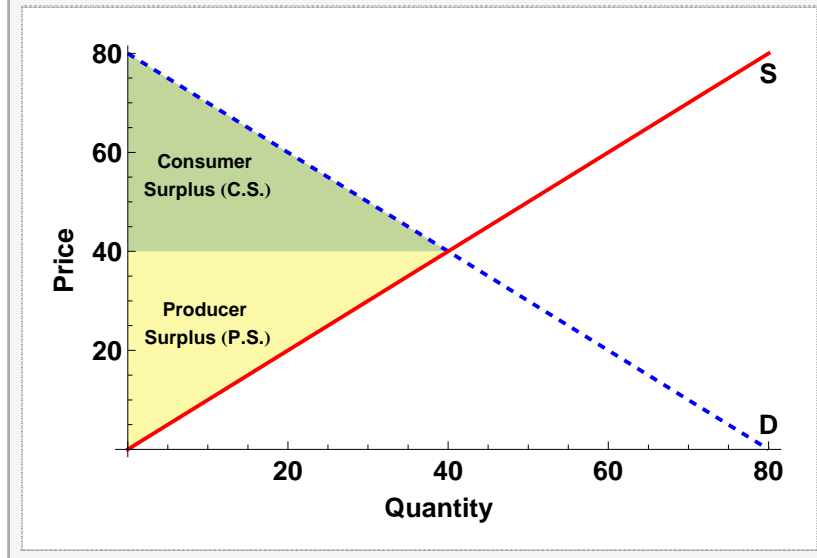
Consumer and Producer Surplus

When the market determines the equilibrium price, consumers and producers can end up with economic surplus.

Consumer and Producer Surplus

Consumer Surplus – the difference between the demand curve (marginal benefit) and the price (marginal cost).

Producer Surplus – The difference between the price (marginal benefit) and the supply curve (marginal cost).



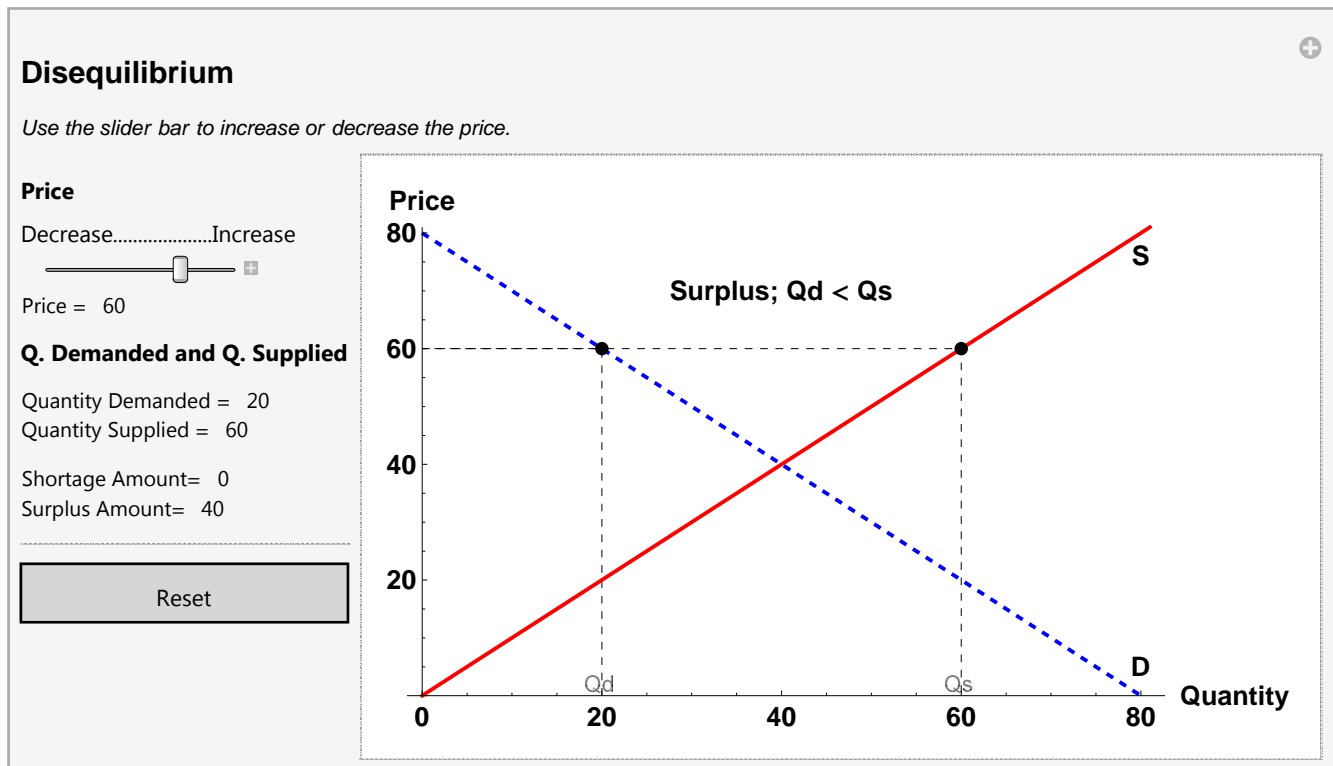
Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

A consumer purchases the 40th unit of a good for a price of \$40. At this price, what the consumer pays (their marginal cost) is equal to what they were willing to pay (the marginal benefit). This means that the price the consumer pays is on the demand curve. If we look at the graph above, notice that if the price is \$40, the consumer was willing to pay only \$40 for the 40th unit. However, for the 1st to 39th units of the good the consumer was willing to pay more but only paid \$40. They were willing to pay \$80 for the 1st unit and a little less for each additional unit. This difference between the demand curve, i.e., what consumers were willing to pay and the price, i.e., what consumers had to pay, is known as the **consumer surplus**. To calculate the consumer surplus, find the area of the green triangle above. It is found by find the length of the two sides of the triangle and multiplying them together and dividing by 2. e.g. $(80-40) \times (40-0) = 1600/2 = 800$. The consumer surplus is 800.

The marginal cost of producing a good is represented by the supply curve. The price received by the sale of the good would be the marginal benefit to the producer, so the difference between the price and the supply curve is the producer surplus. In other words, the **producer surplus** is the additional return to producers above what is required to produce that quantity of goods, i.e. to cover costs. To calculate the producer surplus, find the area of the yellow triangle above. It is found by find the length of the two sides of the triangle and multiplying them together and dividing by 2. e.g. $(40-0) \times (40-0) = 1600/2 = 800$. The producer surplus is 800.

Disequilibrium

If the price is above or below the equilibrium price, then the market is in **disequilibrium**. The market forces will move from a state of disequilibrium to equilibrium. If quantity supplied is greater than quantity demanded, then there is a **surplus** in the market. In other words, firms are producing more goods than consumers are buying. This will put downward pressure on the price.



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For example, in the graph above the price is currently at 60, which is above the equilibrium price. If we decrease the price to 40, the quantity supplied will decrease as the price goes down and the quantity demanded will increase as the price. This is because firms supply less quantity at lower prices and consumers demand more quantity at lower prices.

At a price of 40, the market is in equilibrium, which means quantity supplied equals quantity demanded. If the price is 20, then the market is in disequilibrium (move the price to 20 in the graph above). At this price quantity demanded is greater than quantity supplied. There is a shortage in the market. This means that consumers are demanding 60 units of the good, but firms are only willing to supply 20 units. The price will have to increase to give the incentive for firms to supply more. As the price increases consumers will not demand as many units of the good. This continues until we reach a price of 40.

Derived Demand and Supply Shocks

The demand for an input or resource is derived from the demand for the good or service that uses the resource. We do not value steel in and of itself, but since we demand cars, we indirectly demand steel. If the demand for cars increases, this would cause an increase in the demand for the steel that is used to make the cars. Likewise, since steel is an input into the production of cars, if there is a negative supply shock that decreases the amount of steel available then it will negatively impact the production of cars.

Derived Demand and Supply Shocks

If the demand for cars increases, then the demand for steel increases.

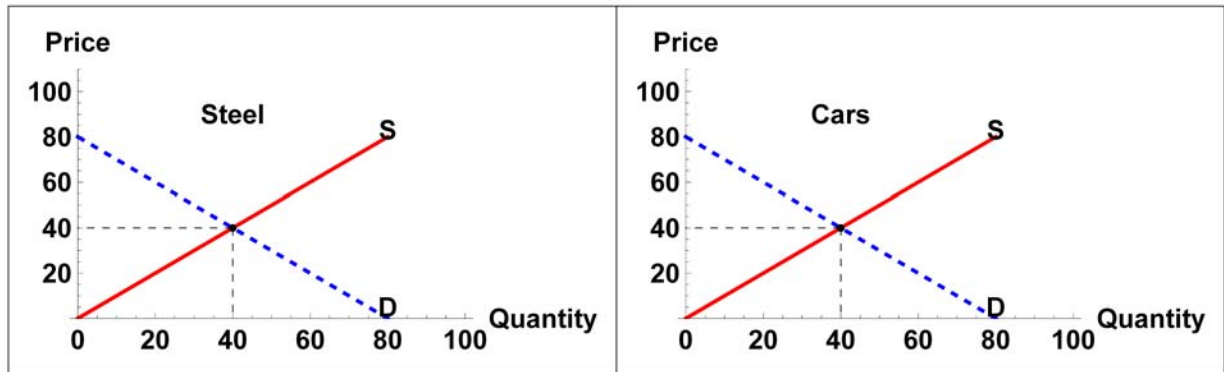
If the demand for cars decreases, then the demand for steel decreases.

Demand For Cars

If there is a supply shock that decreases the supply of steel, then the supply of cars will decrease.

Supply Shock

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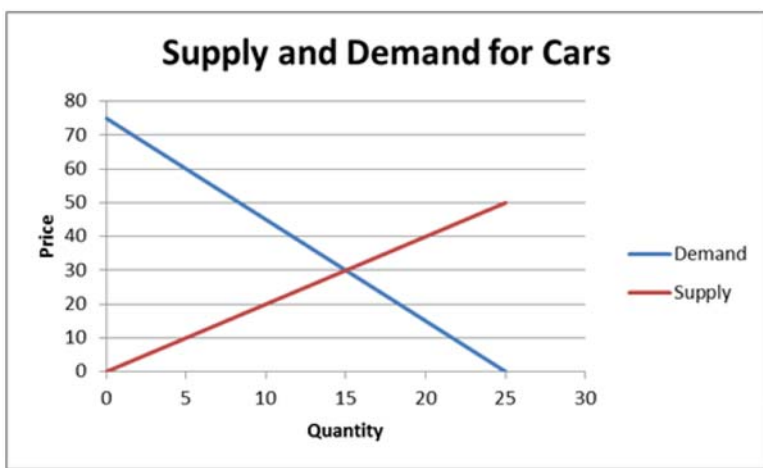
Ponder and Prove - Section 3 - Equilibrium

Section 3 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

Question 1 Question 2 Question 3

What is the consumer surplus for cars based on the graph below?
(Note: Demand crosses the y-axis at 75. Supply crosses the y-axis at 0.)



- 337.5
 225
 450
 675

Grade My Answer

Reset

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus

Section 4: Shifts in Supply and Demand

Shifts in Supply and Demand

The factors of supply and demand determine the equilibrium price and quantity. As these factors shift, the equilibrium price and quantity will also change.

Demand Curve Shifts

Use the slider bar to shift the demand curve to the left or the right. When demand shifts in or to the left, there is a lower quantity demanded at each price. When demand shifts out or to the right, there is a higher quantity demanded at each price. Move the slider to find out what happens to equilibrium price and quantity as the demand curve shifts and supply stays constant.

Shifts in the Demand Curve

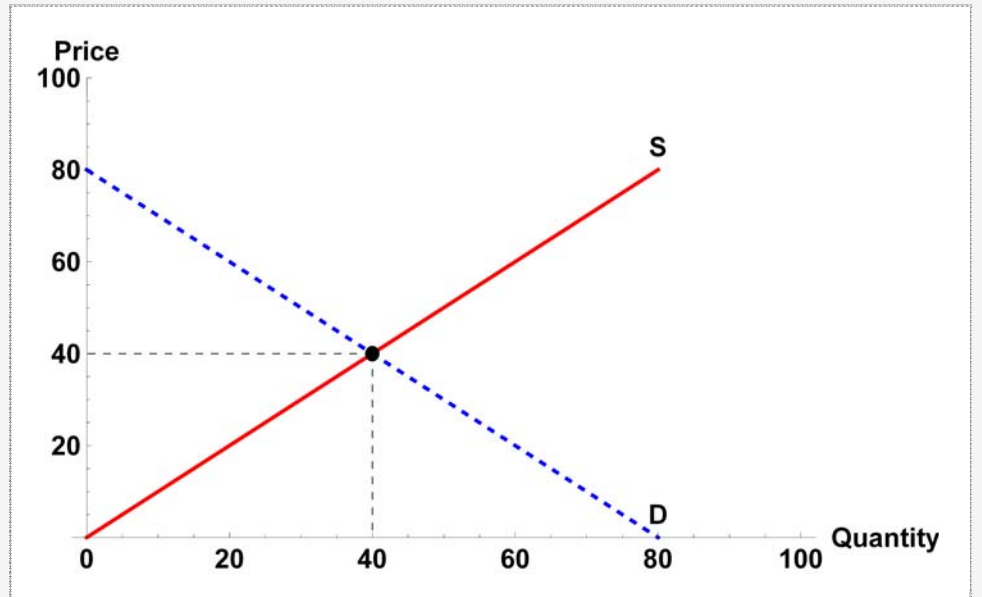
Left.....Right



Demand Shifts

	≠	↑ or ↓
Eq. Price =	40	
Eq. Quantity =	40	

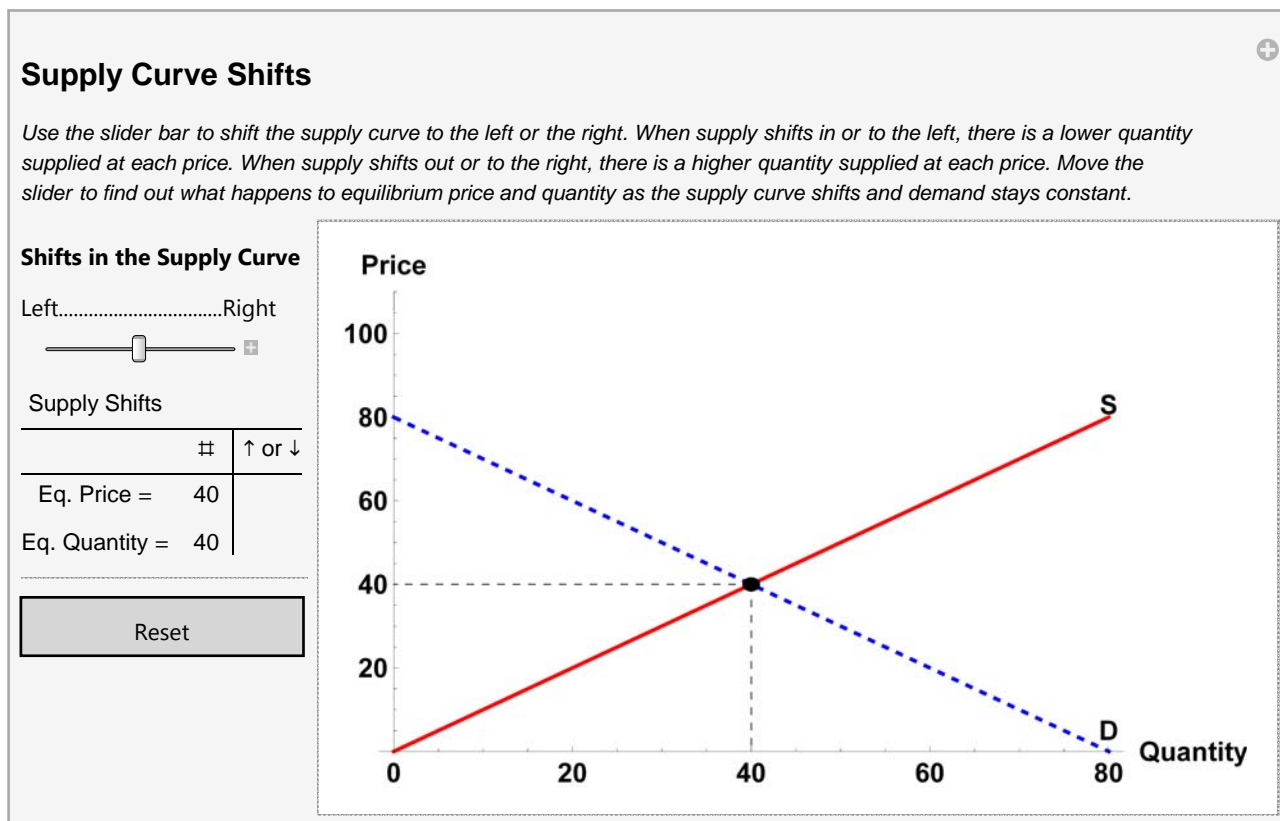
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Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

If the demand decreases, for example a particular style of sunglasses becomes less popular, i.e., a change a tastes and preferences, the quantity demanded at each price has decreased. At the current price there is now a surplus in the market and pressure for the price to decrease. The new equilibrium will be at a lower price and lower quantity. Note that the supply curve does not shift but a lower quantity is supplied due to a decrease in the price.

If the demand curve shifts right, there is a greater quantity demanded at each price. The newly created shortage at the original price will drive the market to a higher equilibrium price and quantity. As the demand curve shifts the equilibrium price and quantity will change in the same direction, i.e., both will increase or both will decrease.



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

If the supply curve shifts left, say due to an increase in the price of the resources used to make the product, there is a lower quantity supplied at each price. The result will be an increase in the market equilibrium price but a decrease in the market equilibrium quantity. The increase in price, causes a movement along the demand curve to a lower equilibrium quantity demanded.

A rightward shift in the supply curve, say from a new production technology, leads to a lower equilibrium price and a greater quantity. Note that as the supply curve shifts, the change in the equilibrium price and quantity will be in opposite directions.

Complex Cases - Shifting Supply and Demand

When demand and supply are changing at the same time, the analysis becomes more complex. In such cases, we are still able to say whether one of the two variables (equilibrium price or quantity) will increase or decrease, but we may not be able to say how both will change. When the shifts in demand and supply are driving price or quantity in opposite directions, we are unable to say how one of the two will change without further information. Move the supply and demand curves above to see how equilibrium price and quantity change.

Supply and Demand Curve Shifts – Complex Cases

Use the slider bar to shift the supply and demand curves to the left or the right. Watch what happens to equilibrium price and quantity. The arrows in the table indicate if the equilibrium price and quantity has increased (↑), decreased (↓), or stayed at the same value (↔).

Shifts in the Demand Curve

Left.....Right



Shifts in the Supply Curve

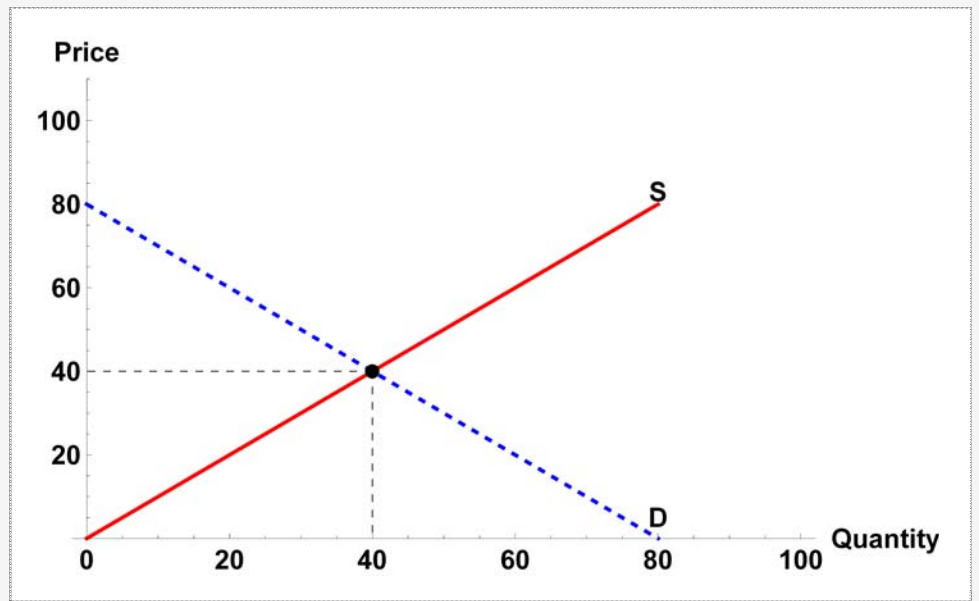
Left.....Right



⌘ | ↑, ↓, ↔

Eq. Price =	40.	↔
Eq. Quantity =	40.	↔

Reset



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

The table below summarizes how changes in supply and demand impact equilibrium price and quantity. When supply and demand move in opposite directions, then equilibrium price increases or decreases. However, the change in quantity is unknown. We must know which curve shifts more to figure out whether or not equilibrium quantity increases or decreases. When supply and demand move in the same direction, the equilibrium quantity increases or decrease, but we do not know how the price will change. We would need to know which curve shifts more (supply or demand) to determine if equilibrium price increases or decreases.

Complex Cases – Summary

When demand and supply are changing at the same time, the analysis becomes more complex. The table below summarizes these changes. Notice there are times when changes in supply and demand will increase or decrease price, but the change in quantity is unknown. This happens when supply and demand move in opposite directions. When supply and demand move in the same direction then quantity either increases or decreases, but the change in price is unknown.

Change in Supply	Change in Demand	Effect on Equilibrium Price	Effect on Equilibrium Quantity
Increase	Decrease	Decrease	??
Decrease	Increase	Increase	??
Increase	Increase	??	Increase
Decrease	Decrease	??	Decrease

Complex Cases - Solving for Equilibrium Algebraically

We are able to find the market equilibrium by analyzing a schedule or table, by graphing the data, or solving equations algebraically. While it is easy to ready a table or look at a graph to find equilibrium, it is harder to algebraically

solve for equilibrium. We will review how to solve for equilibrium below.

The data can also be represented by equations.

$$P = 50 - 2Q_d \text{ and } P = 10 + 2Q_s$$

Solving the equations algebraically will also enable us to find the point where the quantity supplied equals the quantity demanded and the price where that will be true. We do this by setting the two equations equal to each other and solving. The steps for doing this are illustrated below.

As stated above, at equilibrium $Q_d = Q_s = Q$. Our first step is to get the Q_s together, by adding $2Q$ to both sides. On the left hand side, the negative $2Q$ plus $2Q$ cancel each other out, and on the right side $2Q$ plus $2Q$ gives us $4Q$. Our next step is to get the Q by itself. We can subtract 10 from both sides and are left with $40 = 4Q$. The last step is to divide both sides by 4, which leaves us with an equilibrium Quantity of 10.

Given an equilibrium quantity of 10, we can plug this value into either the equation we have for supply or demand and find the equilibrium price of \$30. Either graphically or algebraically, we end up with the same answer.

Step-by-Step Solving Algebraically

1. Quantity supplied equals quantity demanded at equilibrium: $Q_d = Q_s = Q$
(step 1)
2. Set the two equations equal to each other: $50 - 2Q = 10 + 2Q$ (step 2)
3. Get Q_s together. Add $2Q$ to both sides:
(step 3) $50 - 2Q + 2Q = 10 + 2Q + 2Q$
 $50 = 10 + 4Q$
4. Get Q by itself by subtracting 10 from both sides:
(step 4) $50 - 10 = 10 - 10 + 4Q$
 $40 = 4Q$
5. Divide both sides by 4. Solve for eq. quantity = Q^* :
(step 5) $40/4 = 4Q/4$
 $10 = Q^*$
6. Plug $Q^* = 10$ back into an equation to get eq. price = P^* : $P = 50 - 2(10)$ or $P = 10 + 2(10)$
(step 6) $P^* = 30$ or $P^* = 30$

Ponder and Prove - Section 4 - Shifts in Supply and Demand

Section 4 Questions +

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

Question 1

Question 2

Question 3

Given the following supply and demand curves, what is the equilibrium quantity and price?

$$P = 140 - 3QD$$

$$P = 40 + 2QS$$

- Price = 112, Quantity = 36
- Price = 80, Quantity = 20
- Price = 32, Quantity = 36
- Price = 20, Quantity = 80

Grade My Answer

Reset

"Results"

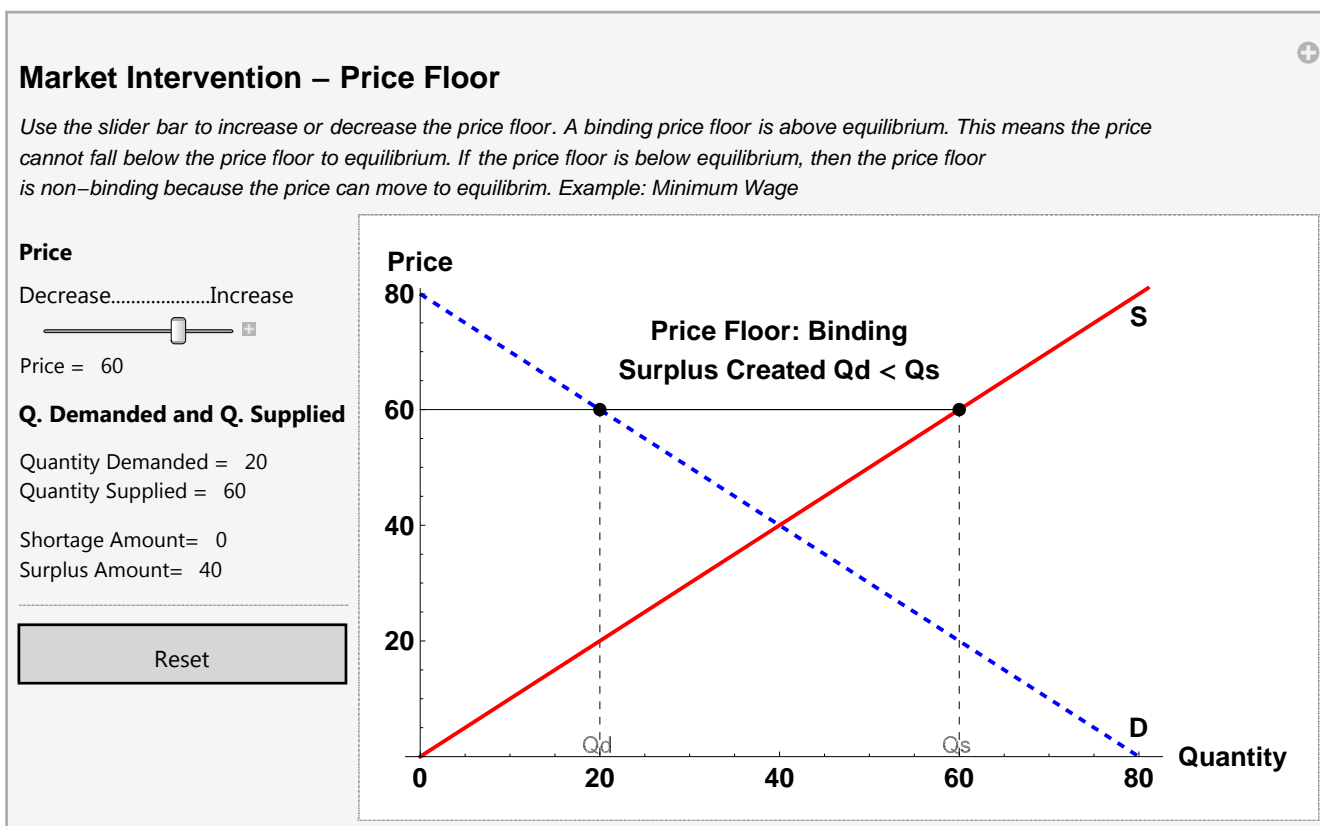
Original source code for problem above from Craig Bauling. Modified by David Barrus

Section 5: Market Intervention

If a competitive market is free of intervention, market forces will always drive the price and quantity towards the equilibrium. However, there are times when government feels a need to intervene in the market and prevent it from reaching equilibrium. While often done with good intentions, this intervention often brings about undesirable secondary effects. Market intervention often comes as either a price floor or a price ceiling.

Market Intervention - Price Floor

A **price floor** sets a minimum price for which the good may be sold. Price floors are designed to benefit the producers providing them a price greater than the original market equilibrium. To be effective, a price floor would need to be above the market equilibrium. At a price above the market equilibrium the quantity supplied will exceed the quantity demanded resulting in a surplus in the market.



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

For example, the government imposed price floors for certain agricultural commodities, such as wheat and corn. At a price floor, greater than the market equilibrium price, producers increase the quantity supplied of the good. However, consumers now face a higher price and reduce the quantity demanded. The result of the price floor is a surplus in the market.

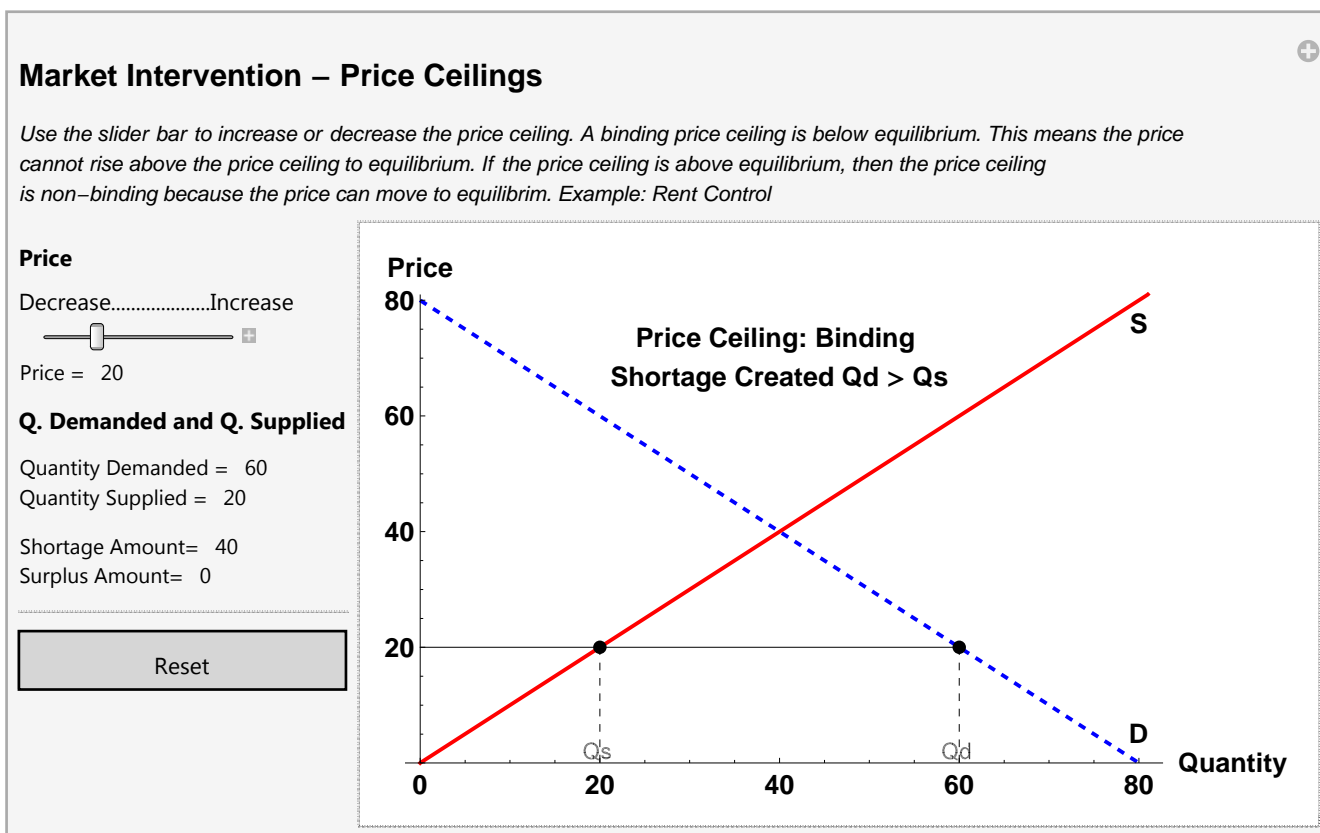
Since producers are unable to sell all of their product at the imposed price floor, they have an incentive to lower the price but cannot. To maintain the price floor, governments are often forced to step in and purchase the excess product, which adds an additional costs to the consumers who are also taxpayers. Thus the consumers suffer from both higher prices but also higher taxes to dispose of the product.

The decision to intervene in the market is a normative decision of policy makers. Is the benefit to those receiving a higher wage greater than the added cost to society? Is the benefit of having excess food production greater than the additional costs that are incurred due to the market intervention?

Another example of a price floor is a minimum wage. In the labor market, the workers supply the labor and the businesses demand the labor. If a minimum wage is implemented that is above the market equilibrium, some of the individuals who were not willing to work at the original market equilibrium wage are now willing to work at the higher wage, i.e., there is an increase in the quantity of labor supplied. Businesses must now pay their workers more and consequently reduce the quantity of labor demanded. The result is a surplus of labor available at the minimum wage. Due to the government imposed price floor, price is no longer able to serve as the rationing device and individuals who are willing and able to work at or below the going minimum wage may not be able to find employment.

Market Intervention - Price Ceiling

Price ceilings are intended to benefit the consumer, and the government sets a maximum price for which the product may be sold. To be effective, the price ceiling must be below the market equilibrium. Some large metropolitan areas control the price that can be charged for apartment rent. The result is that more individuals want to rent apartments given the lower price, but apartment owners are not willing to supply as many apartments to the market (i.e., a lower quantity supplied). In many cases when price ceilings are implemented, black markets or illegal markets develop that facilitate trade at a price above the set government maximum price.



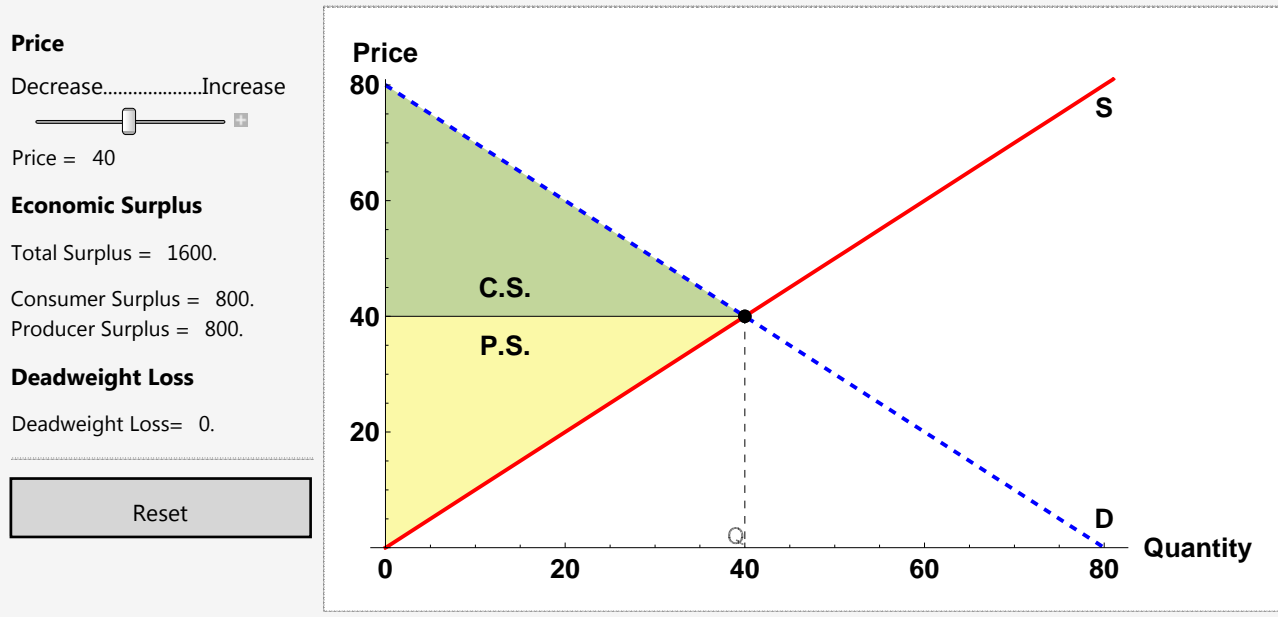
Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

Impacts of Market Intervention

It is important to understand the impact of government intervention (i.e. price floors, price ceilings, subsidy, and taxes) on economic surplus.

Market Intervention – Price Ceilings, Price Floors, & Deadweight Loss

Use the slider bar to increase or decrease the price. The graph starts at equilibrium with no deadweight loss. A binding price ceiling is below equilibrium. A binding price floor is above equilibrium. For both the binding price floor and price ceiling, the price is different than the competitive equilibrium. This results in deadweight loss (Dw.L.), which is the area in black. Consumer surplus (C.S.) is the green area. Producer surplus (P.S.) is the yellow area.



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

In a competitive market, the economic surplus which is the combined area of the consumer and producer surplus is maximized.

When a price floor is imposed, there is a loss in the economic surplus (consumer surplus plus producer surplus) known as **deadweight loss (Dw.L.)**. Since consumer surplus is the area below the demand curve and above the price, with the price floor the area of consumer surplus is reduced. Producer surplus which is below the price and above the supply or marginal cost curve increases. For example, in the graphic above increase the price to 50. Notice that consumer surplus has decreased from 800 to 450, and that producer surplus has increased from 800 to 1050. However, total surplus has declined from 1600 to 1500. This illustrates that when the market price is at equilibrium (supply equals demand) total surplus is at its highest amount. When a price floor is implemented, some of that surplus is lost because some consumers could have purchased the good at the lower price, but are not able to purchase it at the higher price. This surplus is “lost” with respect to the competitive equilibrium (supply equals demand) where surplus is at its highest point. We call this lost surplus deadweight loss.

A price ceiling also creates a deadweight loss. Move the slider in the graphic above to a price of 25 and notice how the consumer and producer surplus changes. The overall result is that total surplus is lower when price ceilings and price floors are implemented.

Excise Tax

Another government market intervention is the imposition of a tax or subsidy.

Market Intervention – Excise Tax, Tax Revenue, & Deadweight Loss

Use the slider bar to increase the excise tax. The graph starts at equilibrium with no deadweight loss or tax revenue. As the tax increases consumer and producer surplus becomes deadweight loss and tax revenue. The deadweight loss (Dw.L.) is the area in black. Consumer surplus (C.S.) is the green area. Producer surplus (P.S.) is the yellow area. Tax revenue is in the orange area.

Tax and Tax Revenue

0 40



Tax = 0

Tax Revenue = 0.

Eq. Price = 40.

Economic Surplus

Total Surplus = 1600.

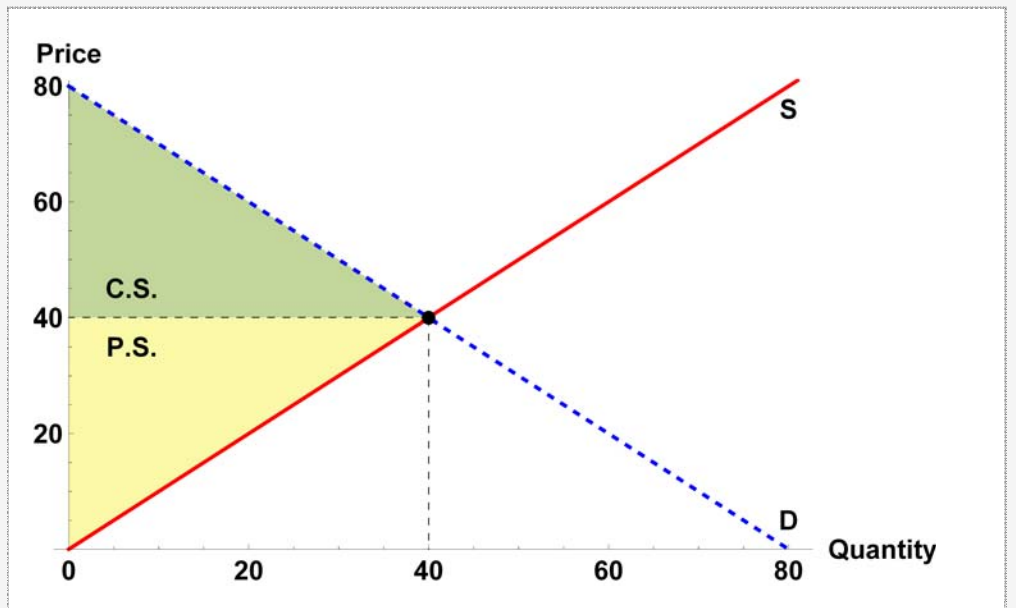
Consumer Surplus = 800.

Producer Surplus = 800.

Deadweight Loss

Deadweight Loss = 0.

Reset



Original source code for graph above from Javier Puertolas. Modified by David Barrus and Victoria Cole.

An **excise tax** is a tax levied on the production or consumption of a product. To consumers, the tax increases the price of the good purchased moving them along the demand curve to a lower quantity demanded. The vertical distance between the original and new supply curve is the amount of the tax. Due to the tax, the new equilibrium price is higher and the equilibrium quantity is lower. While the consumer is now paying price the producer only receives a lower price after paying the tax.

Due to the tax, the area of consumer surplus is reduced and producer surplus is reduced. The tax revenue is equal to the tax per unit multiplied by the units sold. The deadweight loss gets bigger as the tax gets bigger.

Ponder and Prove - Section 5 - Market Intervention

Section 5 Questions +

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

Question 1
Question 2
Question 3

What is the result of the government increasing the amount of an excise tax?

- Consumer surplus decreases, producer surplus decreases, deadweight loss decrease, and tax revenue decreases
- Consumer surplus increases, producer surplus increases, deadweight loss decrease, and tax revenue decreases
- Consumer surplus increases, producer surplus increases, deadweight loss increases, and tax revenue increases
- Consumer surplus decreases, producer surplus decreases, deadweight loss increases, and tax revenue increases

Grade My Answer
Reset

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus

Summary

Key Terms

Change in demand: a change in the overall demand for a particular good or service. (shift of the demand curve).

Change in quantity demanded: a change in the amount of a good demanded by consumers due to changes in the price of the good. (movement along demand curve)

Change in quantity supplied: a change in the amount of a good supplied by producers due to a change in the price of the good. (movement along supply curve)

Change in supply: a change in the overall supply of a particular good or service. (shift of the supply curve).

Complements: two or more goods that are consumed together.

Consumer surplus: is the difference between what consumers were willing to pay and what they actually paid.

Deadweight loss: lost economic surplus; neither the consumer or producer accesses this surplus.

Demand Curve: a graphical representation of our marginal benefit and thus our willingness to pay for additional amounts of a good.

Demand Schedule: shows the combinations of price and quantity demanded of a particular good in a table format.

Derived Demand: the indirect demand for a particular good due to an increase in the demand of a related or finished good.

Disequilibrium: whenever the market price is above or below the equilibrium price (where quantity demanded equals quantity supplied).

Excise tax: a tax levied on the production or consumption of a product.

Factors that shift demand: consumer tastes and preferences, price of related goods, income, number of consumers, and expectations of the future.

Factors that shift supply: resource prices, technique of production, prices of other goods, taxes, subsidies, expecta-

tions of future prices, number of sellers, and supply shocks.

Income Effect: as the price of a good decreases, the consumers' buying power increases.

Inferior Goods: goods that are demanded more when income decreases and are demanded less when income increases.

Law of Demand: there is an inverse (or negative) relationship between the price of a good and the quantity demanded.

Law of Supply: as the price rises (again holding all else constant), the quantity of apples supplied increases.

Market Demand: the summation of the quantity demanded for a good or service by each individual within a market.

Market Equilibrium: the price and quantity combination where quantity supplied equals quantity demanded.

Normal Goods: goods whose demand rises with income increases and falls when income decreases.

Price ceiling: a maximum price, set by the government, that firms can set on a good or service in order to benefit consumers.

Price floor: a minimum price that a good or service can be sold.

Producer surplus: the difference between the price at which the good or service is sold and the cost of production for that quantity.

Shifts in supply and demand: depending on the shift in the demand and/or supply curve, the market price and/or quantity will change.

Shortage: the condition in which the quantity demanded is larger than the quantity supplied in the market place.

Solving algebraically: setting the equation for quantity supplied equal to the equation for quantity demanded to solve for the market equilibrium algebraically. For example:

$$Q_d = 2P + 10 \text{ and } Q_s = 4P - 5$$

$$2P + 10 = 4P - 5$$

$$15 = 2P$$

$$P = 7.5$$

$$Q_d = 2(7.5) + 10$$

$$Q_d = 25$$

Substitutes: a good that can take the place of the other good.

Substitution effect: as the price of the good declines, it becomes relatively less expensive compared to the price of other goods, and thus the quantity demanded is greater at a lower price.

Supply curve: a graphical representation showing the amount that producers are willing and able to supply to the market at each given price.

Surplus: the condition where the quantity supplied is greater than the quantity demanded in the marketplace.

Objectives

Section 1:

1. Describe how the demand curve is derived and the law of demand is applied
2. Explain the law of demand and why the demand curve is downward sloping.
3. Explain the difference between the substitution effect and the income effect.
4. Explain how the demand curve reflects marginal benefit and willingness to pay.
5. Explain the factors of demand and how the demand curve shifts with changes in tastes and preferences; prices of related goods - substitutes and complements; income - normal and inferior goods; expectations about the future; and market definition.
6. Explain the difference between shifts in demand and changes in quantity demanded.
7. Compute the market demand from individual demand curves.
8. Graph a demand curve using tabular data.

Section 2:

1. Describe how the supply curve is derived and the law of supply is applied.
2. Explain the law of supply and why the supply curve is upward sloping.
3. Explain how the supply curve reflects marginal cost.
4. Explain the factors of supply and how the supply curve shifts with changes in resource prices; technique of production; price of other goods; taxes & subsidies; price expectations; number of sellers; time frame, and supply shocks.

5. Explain the difference between shifts in supply and changes in quantity supplied.
6. Compute the market supply from individual supply curves.

Section 3:

1. Explain how the market efficiently allocates resources to reach equilibrium and how the market responds when not at the equilibrium.
2. Determine the market equilibrium both graphically and algebraically.
3. Define and calculate the consumer and producer surplus.
4. Explain why in a competitive market, the market will always move towards equilibrium.
5. Discuss how the market will eliminate shortages and surpluses in a market.

Section 4:

1. Demonstrate how changes in demand and supply change the equilibrium price and quantity.
2. Determine the market equilibrium both graphically and algebraically.

Section 5:

1. Demonstrate the impact of government intervention in the market.
2. Demonstrate the impact of price intervention in the market including both a price floor and ceiling.
3. Identify those who benefit and are hurt by price intervention.
4. Define and calculate the deadweight loss associated with price intervention.
5. Discuss why black markets develop with government intervention.
6. Demonstrate the impact of a tax on the market.