Managerial Economics & Business Strategy

Market Forces: Demand and Supply

Welcome all to Session 2: demand and supply. This session gives you the building blocks for any kind of market analysis. The tools of this chapter help managers to answer crucial questions such as how much to produce? At what price?

Overview

I. **Market Demand Curve**
  – The Demand Function
  – Determinants of Demand
  – Consumer Surplus

II. **Market Supply Curve**
  – The Supply Function
  – Supply Shifters
  – Producer Surplus

III. **Market Equilibrium**
IV. **Price Restrictions**
V. **Comparative Statics**

You can read through practically any chapter on demand and supply in introductory Microeconomics textbooks. Most of the textbooks will cover basic concepts discussed today. Some of you may have already done this topic in introductory microeconomics.

Market Demand and Supply Curve- In the economic sense demand curve captures the relationship between price and quantity from the buyers perspective whereas the supply curve captures this relationship from the suppliers perspective.

Market equilibrium is where demand and supply curves meet.

We will come to price restrictions in the market later on but for now remember that we are referring to this idea to capture the notion of price regulations in markets.

Very broadly we use comparative statics to compare different equilibrium

states.

Market Demand Curve

- Shows the amount of a good that will be purchased at alternative prices, holding other factors constant.
- *Law of Demand*
  - The demand curve is downward sloping.
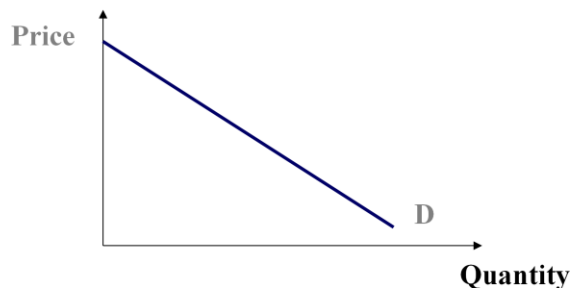
Price — Quantity — D

Market demand curve is an aggregate of individual demand curves. Holding all other things constant or cetrus paribus (sorry about more terminology), market demand curve tells you how much quantity will be demanded at alternative prices. It is downward sloping, meaning price of a good falls, quantity demanded rises. This should be fairly intuitive. We buy more if things get cheaper and vice versa. In other words a demand curve shows the relationship between quantity demanded of a good and its price, when everything else that can possibly affect the demand of that particular good is held constant.

Now I want to emphasize a point here, what the above curve shows here is the quantity demanded at different prices. It is important to remember the key word "quantity demanded". A particular quantity demanded is not just a wish list, that we were dreaming about at night, but is lot more specific. Quantity demanded shows what consumers plan to buy during a particular time period for a given price and they have the ability to buy. It is therefore also called willingness and ability to pay curve.

Determinants of Demand

- Income
  - Normal good
  - Inferior good
- Prices of Related Goods
  - Prices of substitutes
  - Prices of complements
- Advertising and consumer tastes
- Population
- Consumer expectations

So we just spoke about the relationship price and quantity demanded, holding everything else constant. This slide lists the factors that cause the demand curve to shift and this referred to as change in demand. This is different from the previous slide because there we were talking about the movement in the demand curve as price changed. Coming back to the demand curve, economists do realize that factors other than price affect the demand. Some of the determinants of demand include:

Income- For most goods as our income goes up we demand more of it. For example I would like to buy a house if I get paid more. As I get paid more I want more! Goods such T.V, car, house, gourmet food are all normal goods. And, hence, the positive relationship. However, the relationship is different for inferior goods. To me a burger at MacDonald's is a inferior good. As my income goes up, I would like less of McDonald burgers. This may not hold true for each human being on planet earth. What we are talking here is about general patterns not a scientific law.

Prices of substitutes- To use textbook definition substitutes are "Goods for which an increase (decrease) in the price of one good leads to an increase (decrease) in the demand for the other good" (Baye 2010, p.40). Or a simple way is to think of Coke and Pepsi. If price of Coke goes up most people would shift to Pepsi. Hence, the demand curve for Pepsi will shift to the right.

Prices of complements: To use textbook definition again, complements are "Goods for which an increase (decrease) in the price of one good

leads to a decrease (increase) in the demand for the other good." Another way to think about this is Tennis ball and rackets. These two things go together. If rackets become too expensive then people's demand for playing tennis and hence tennis balls is going to go down.

Advertising and tastes- Advertising can change the demand for a product by informing consumers about the existence or quality of a product. Can also change the demand by altering consumer preferences. For example, I may have no preference for carrying designer handbags but advertising may convince me that it is cool to do so. Tastes may also change for other reasons. For example, an ageing population can create a greater demand for classical music.

Population- I think this is simple. More people-more consumption of absolutely everything.

Consumer expectations-Suppose I think that my dream home's is going to be twice as expensive in six months. What do you think I will do? Buy my dream home today if I can. This is simply the effect of consumer expectations.

Are there any other factors? Yes. Anything that affects the willingness or ability of consumers to purchase a particular good is a determinant of demand.

When the above factors change, we say that there is a change in demand or a shift in the demand curve.

The Demand Function

- A general equation representing the demand curve

$$Q_x^d = f(P_X, P_Y, M, H,)$$

- Q_x^d = quantity demand of good X.
- P_x = price of good X.
- P_Y = price of a related good Y.
  - Substitute good.
  - Complement good.
- M = income.
  - Normal good.
  - Inferior good.
- H = any other variable affecting demand.

To represent all that mathematically we use the demand fund function. On the slide we have quantity demanded of good x is a function of price of good X, price of good Y, income and any other variable affecting demand. The beauty of this is that mathematically we can represent something so neatly and precisely without having to waste pages over it. A possible demand function can be a aggregation of these factors where we calculate how each factor affects demand, holding everything else constant and then add them up to find the quantity demanded at a certain price.

Inverse Demand Function

- Price as a function of quantity demanded.
- Example:
  - Demand Function
    - $Q_x^d = 10 - 2P_x$
  - Inverse Demand Function:
   - $2P_x = 10 - Q_x^d$
    - $P_x = 5 - 0.5Q_x^d$

Such a linear demand function can be represented as $Q_x^d = 10 - 2P_x$

I want you to think of high school here. This is simple representing the equation y=a+bx. This is an equation of a straight line. Remember a is the intercept and b is the slope. To follow mathematical convention, y is on the vertical axis and x is on the horizontal axis.

In the equation $Q_x^d = 10 - 2P_x$, 10 is the intercept and -2 is the slope.

Inverse demand function just turns the equation around in terms of price. So essentially the equation $Q_x^d = 10 - 2P_x$ is equivalent to $P_x = 5 - 0.5Q_x^d$. So now if you plot this equation, you can have price on the vertical axis, quantity on the horizontal axis, the intercept will be 5 and slope will be -0.5. Since the slope is negative this is a downward sloping line.

Change in Quantity Demanded

Price

A to B: Increase in *quantity demanded*

10 ...... A

6 ...... B

D_0
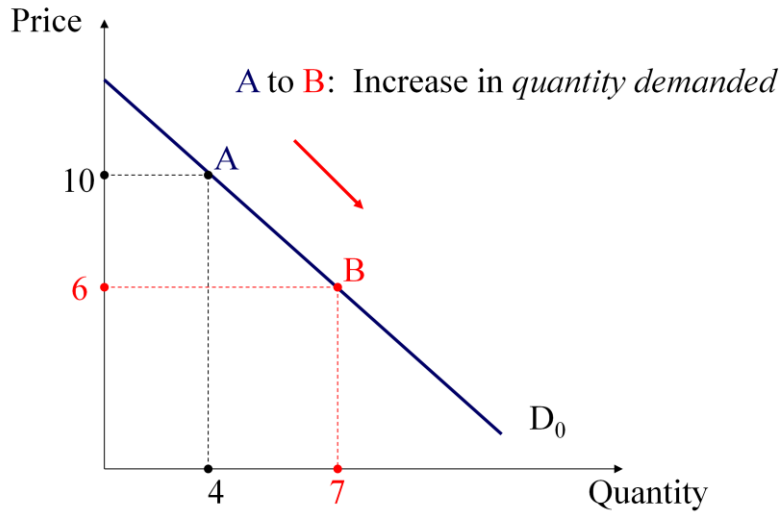
4   7   Quantity

The inverse demand function is typically used to plot the demand curve. Now since we have a negative relationship between quantity demand and price, we get a downward sloping demand curve. Law of demand essentially says that holding all other things constant, as the price of a good rises the quantity demanded of the good falls.
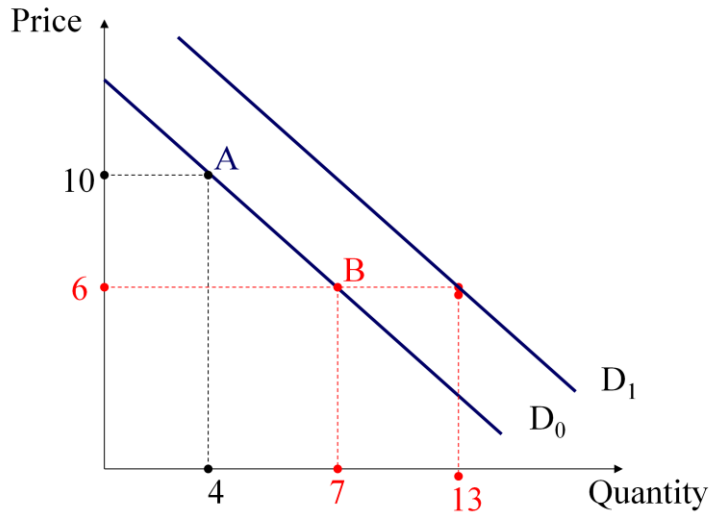
Change or shift in demand can be caused by a variety of factors. I am told eating burgers is good for health and so my demand for burgers increases at each price. This can be illustrated in the diagram as shift in D_0 to D_1. So at price of $6 I was consuming 7 burgers which after the health report now increases to 13 burgers! Here the demand has increased or the demand curve has shifted right. In other words the quantity I wish to buy at each and every price has increased. However when the price changes, there is a change in

quantity demanded and a movement along the curve.

Task

- What is the difference between a change in demand and a change in quantity demanded? Explain how each of the following factors will operate to bring about a change in demand?
- The price of related goods
- Expected future prices
- Income
- Expected future income and credit
- Population
- Preferences

Lets break to do this exercise.

I got a great deal!

- That company offers a lot of bang for the buck!
- Dell provides good value.
- Total value greatly exceeds total amount paid.
- Consumer surplus is large.

We will introduce another concept. The consumer surplus captures the notion of value. We usually talk of the notion of a good deal. CS capture this idea of a good or bad deal.

Consumer Surplus

- The value consumers get from a good but do not have to pay for.
- Consumer surplus will prove particularly useful in marketing and other disciplines emphasizing strategies like value pricing and price discrimination.

Consumer surplus is the value consumers get from a good but don't have to pay. Now lets imagine that you are really hungry and have not eaten for a day. You have the option of getting some pizza. Will u be willing to pay $20 for your first slice in this situation. I think the answer is yes. Remember you have not eaten for a day. For the second slice may be you are not so desperate and you are willing to pay only $18 and so on. Now lets imagine you have eaten your 10th slice of pizza. For the 11th slice you may be willing to pay nothing at all. In other words demand curve captures your willingness and ability to pay for each slice of pizza. But in the real world you don't pay different prices for each slice of pizza you consume. The difference between the willingness to pay and what you actually pay is consumer surplus.

Consumer Surplus: Discrete Case
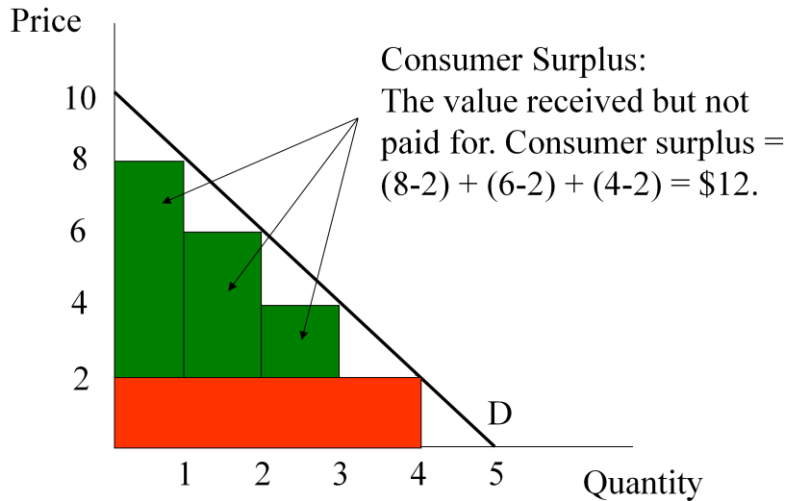
Lets rework this idea of consumer surplus. In the case of discrete goods, such as pizza which works in say number of slices. In a realistic setting where you have not been starved for a day, the 1st slice you may be willing to pay $8 and for second $6 etc. I hope you are able to read the diagram as we practice this. The actual price paid is $2. To calculate consumer surplus all we do is subtract the price we are willing to pay from actually paid for each slice. For

the first slice it 8-2, for the second slice it is 6-2 and for the third it is 4-2. Then we add all these together to get consumer surplus. In this case it is 12.

Consumer Surplus: Continuous Case
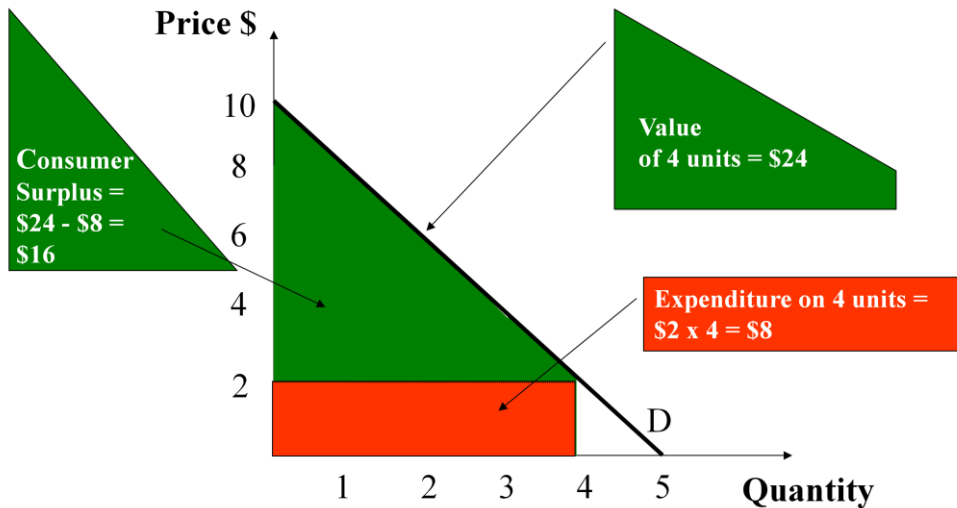
In case of good that can be sold in halves and so on, consumer surplus is the area of the green triangle in the diagram above. The formula is ½ x base x height. In this case it will be ½ x (4-0) x (10-2)=$16.

Market Supply Curve

- The supply curve shows the amount of a good that will be produced at alternative prices.
- *Law of Supply*
  - The supply curve is upward sloping.

Price

S_0
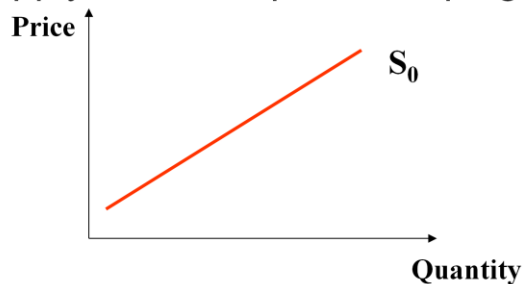
Quantity

Much of the same principles apply to the supply except that we are now looking at the producers perspective. In a market they are many producers and market supply curve is an aggregation of individual supply curves. The quantity supplied is the amount producers plan to sell at a given price when all other factors that can affect the amount produce remain the same. Law of supply states, that holding everything else constant, quantity supplied increases as price increases.

Supply Shifters

- Input prices or costs of production
- Technology or government regulations
- Number of firms
  - Entry
  - Exit
- Substitutes in production
- Taxes
  - Excise tax
  - Ad valorem tax
- Producer expectations

Supply curve shifts or there is a change in supply when any factor influencing selling plans other than the price of the good changes. An increase in supply causes supply curve to shift rightward and a decrease in supply causes supply curve to shift leftward.

So what are the important supply shifters?

Input prices or costs- As input prices rise (e.g labor wages, cost of material, rent), producers are willing to produce less at each price, shifting supply to the left.

Technology or government regulations- Improvement in technology can cause a reduction in costs. For example the introduction of better farming techniques has caused the cost of farming to reduce, shifting the supply curve to the right. Government regulations, for example, lifting to barriers to trade, can reduce costs by opening the doors for producers to buy from different countries and shift the supply curve to the right.

Number of firms- If more firms enter, then more supply.

Substitutes in production simply means are those goods that producer can make instead or goods for which producing more of one requires producing less of the other. Suppose the price of wheat goes up. For a farmer producing rye, wheat is a substitute in production. He can plant wheat instead of rye. Thus , the supply of rye in this case will shift to the left.

Taxes- this effect is more difficult to understand and will depend on the type of tax. An excise is a tax on each unit of output sold. For example a tax of $x on a pack of cigarettes sold will mean that producers have to pay $x on each pack to the government. This will mean that supply will shift to the left by the amount of the tax. Another form of tax is ad-valorem tax. This also popularly known as the sales tax. It is percentage tax and therefore a different amount of tax is associated with different prices. At high price we pay more and at low price we pay less. This tax, thus, shifts the supply curve counter clockwise.

Producer expectation of future prices can change the supply of goods. For example if oil producers believe that price of oil will be high in the future then the supply curve for oil will shift to the left in the current period.

The Supply Function

- An equation representing the supply curve:

$$Q_x^S = f(P_x, P_R, W, H,)$$

- Q_x^S = quantity supplied of good X.
- P_x = price of good X.
- P_R = price of a production substitute.
- W = price of inputs (e.g., wages).
- H = other variable affecting supply.

All the factors that influence the supply of a good can be summarized in a equation or supply function. The above equation shows that quantity supplied of good X (Q_x^S) is a function of price of good x, price of production substitutes, price of inputs and other factors affecting supply. This equation explicitly recognises that the supply of a good is influenced by prices as well other factors.

Inverse Supply Function

- Price as a function of quantity supplied.
- Example:
  - Supply Function
    - $Q_x^s = 10 + 2P_x$
  - Inverse Supply Function:
    - $2P_x = 10 + Q_x^s$
   - $P_x = 5 + 0.5Q_x^s$

An example of a linear supply function is represented as $Q_x^s = 10 + 2P_x$. Since supply curve is usually plotted as price on the vertical or the y axis we take price on the left hand side and everything else on the right hand side. This gives us the inverse supply function.

Change in Quantity Supplied
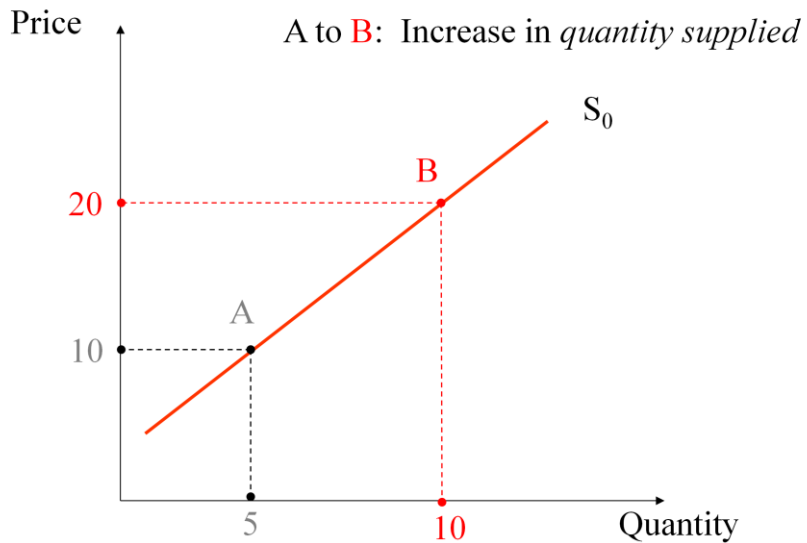
So the supply curve has a positive slope and therefore we get an upward sloping curve. The above slide shows that if price changes from $10 to $20 then the quantity supplied changes from 5 to 10 units. Again note I have used the word quantity supplied. Any change in price causes a change in quantity supplied.

Change in Supply

S_0 to S_1: Increase in supply

Price

S_0

S_1

8

6

5   7   Quantity
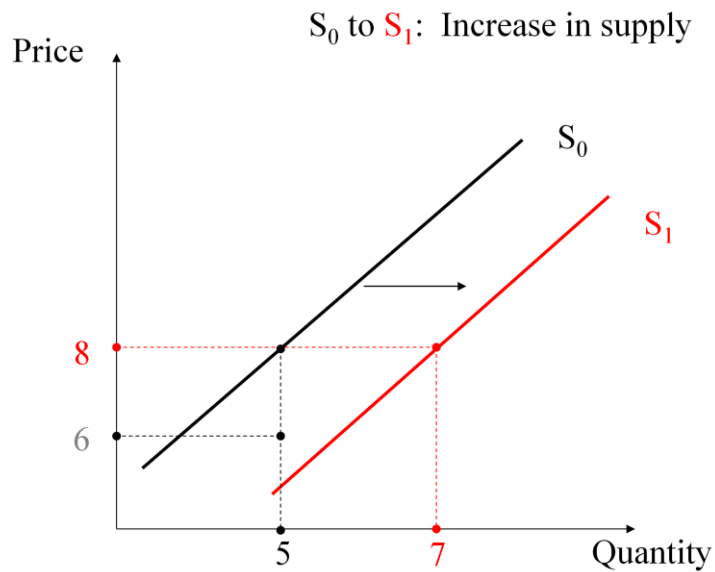
On the other hand lets say the price of petrol goes down. What happens in the transportation industry? Supply increases or shifts rightwards.

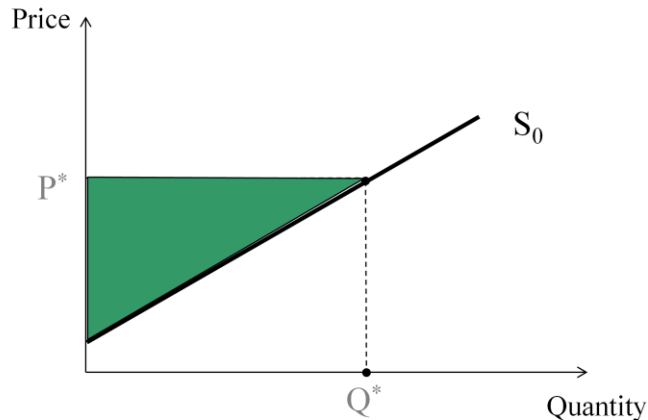# Task

- Draw the graph of the linear function
  Q=-200 + 50P
- Define the inverse supply function.
- Derive and draw the inverse function.
- What is the slope of the inverse function?
- Suppose the function represents supply of widgets. Interpret the slope.
- In each part, fully explain your answer.

Lets break to do this exercise.

Producer surplus is "the amount producers receive in excess of the amount necessary to induce them to produce the good". This is similar to consumer surplus. However, here we are looking at the area above the supply curve but below the market price. Producer surplus captures the difference between the market price and the minimum price at which the producer would have been willing to supply the good. For example, if you very supplying pizza, you may be willing to supply one pizza at a low price. This may be because you can make pizza at home in your free time and sell it to your neighbor at very little expense. If the neighbor wants you to supply large quantities, you might need to take some time off from work to do this task. In this case you may not be willing to supply at a low price. Now suppose the whole locality wants your pizza. This may require a bigger oven, a bigger refrigerator, more time off from work etc. Hence you will need a higher price. However, you don't sell pizza at different prices. You sell all units of pizza you make at one price. Thus, producer surplus is the sum of difference between the price you get from the sale of pizza a particular unit of pizza and the lowest amount that you will be willing to accept that unit of pizza.

Task

Why is the supply curve upward sloping?

Market Equilibrium

- The Price (P) that Balances supply and demand
  - $Q_x^S = Q_x^d$
 - No shortage or surplus
- Steady-state
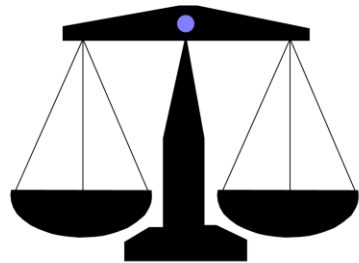
The interaction between buyers and sellers determines the market price. It is the point where market demand is equal to market supply. At the equilibrium point both buyers and sellers are satisfied with the quantities traded. The last point will become clearer if we analyze a situation of disequilibrium.

If price is too low…

Price

S

7

6

5

Shortage
12 - 6 = 6

D
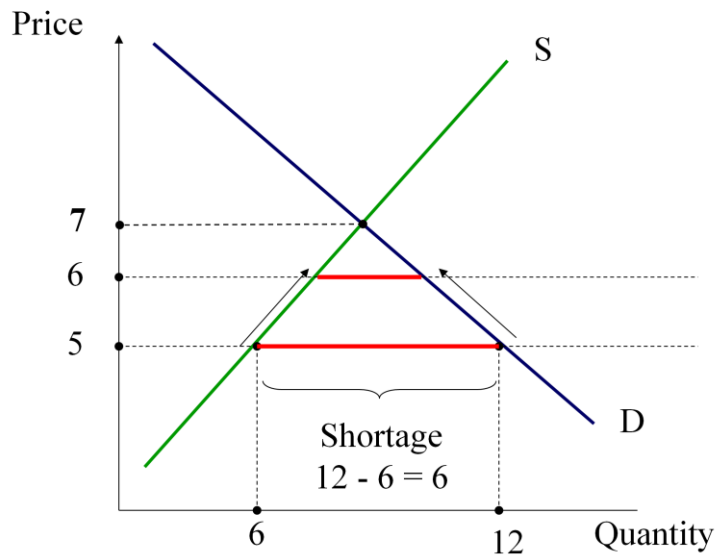
6   12   Quantity

Suppose we are at a point where price is $5. At this point producers are willing to sell only 6 units whereas the quantity demanded is 12 units causing a shortage of 6 units. As price increases quantity demanded decreases while quantity supplied goes up. This process continues until we reach the point where quantity demanded=quantity supplied and price is $7.
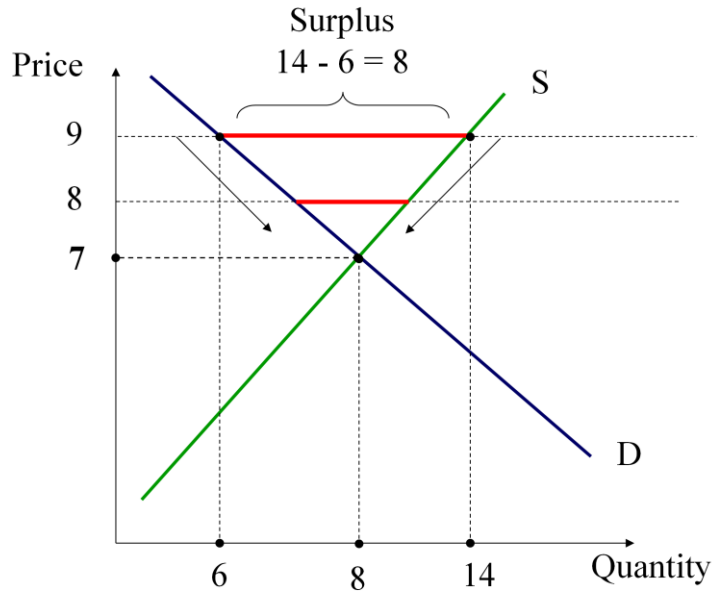
Now lets suppose the price is above the equilibrium. In our example at $9. At this price consumers are willing to purchase only 6 units while producers are supplying 14 units. This causes a surplus of 8 units. As producers are unable to sell all the units produced, the price will fall until the quantity supplied is equal to quantity demanded.

Price Restrictions

- **Price Ceilings**
  - The *maximum* legal price that can be charged.
  - Examples:
    - Gasoline prices in the 1970s.
    - Housing in New York City.
    - Proposed restrictions on ATM fees.

- **Price Floors**
  - The *minimum* legal price that can be charged.
  - Examples:
    - Minimum wage.
   - Agricultural price supports.

What we just discussed was price and output being determined in the free market. In a free market there is a tendency for prices to gravitate towards the equilibrium level. However, sometimes governments intervene in markets which may lead to the price not moving to the equilibrium level causing shortages or surplus. When the government sets the *maximum* legal price that can be charged, it is called price ceiling. When the government sets the *minimum* legal price that can be charged, it is called price floor.

Impact of a Price Ceiling

Price

P^F

P^*

$P^{Ceiling}$

S

D

Shortage

Q_s Q^* Q_d Quantity
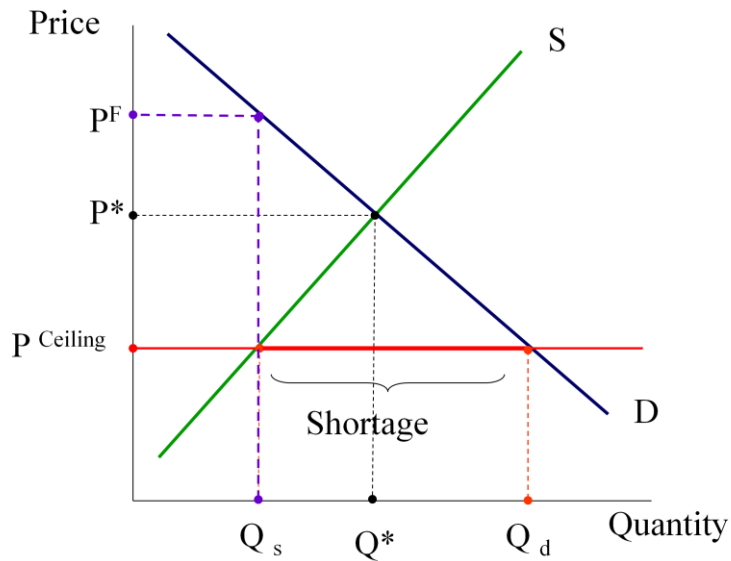
When the price ceiling is below the equilibrium level it can cause chronic shortages. An example is the proposal to limit the ATM fees that the banks can charge. If such a problem comes into effect then it will cause banks to reduce the supply of ATM machines and hence the available number of ATM transactions. Also at the price $P^{Ceiling}$ the demand of ATM transactions will exceed the price and hence cause a shortage. Also note that if price ceiling is above the equilibrium it will have no effect.

Impact of a Price Floor

Price   Surplus   S

P^F

$P*$

D

Q^d $Q*$ Q^S Quantity
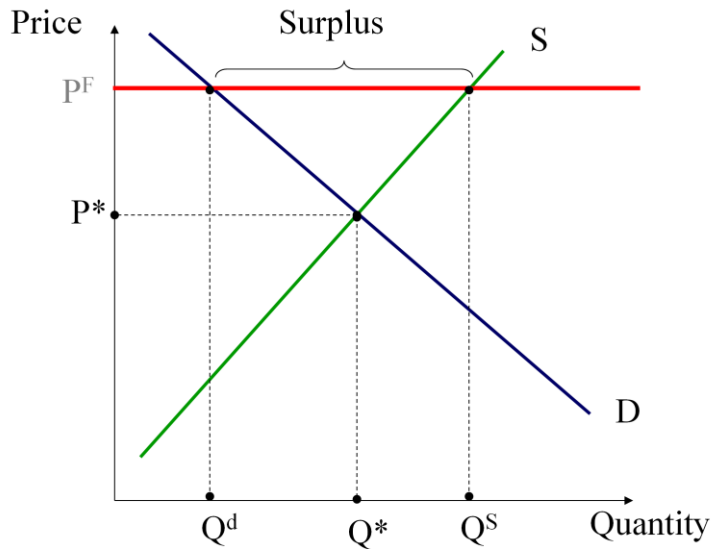
A price floor on the other hand is the minimum price that can be charged. If the price is above the equilibrium it will cause a surplus. For example, if the above diagram represented demand and supply of workers and price represented the wage, then the supply of workers will be more than demand of workers. And there will be a surplus of workers in the market.

Comparative Static Analysis

- How do the equilibrium price and quantity change when a determinant of supply and/or demand change?

We now move on to study of one equilibrium to the other. This is known as comparative static analysis.

Applications: Demand and Supply Analysis

- Event: The *WSJ* reports that the prices of PC components are expected to fall by 5-8 percent over the next six months.
- Scenario 1: You manage a small firm that manufactures PCs.
- Scenario 2: You manage a small software company.

Suppose Wall Street Journal (WSJ) reports that the prices of PC components are expected to fall by 5-8 percent over the next six months. What will you do if you manage a small firm that manufactures PCs? Or what will you do if you also manage a small software company?

Use Comparative Static Analysis to see the Big Picture!

- *Comparative static analysis* shows how the equilibrium price and quantity will change when a determinant of supply or demand changes.

Such a situation calls for the use of comparative static analysis, which shows how the equilibrium price and quantity will change when a determinant of supply or demand changes.

Scenario 1: Implications for a Small PC Maker

- Step 1: Look for the "Big Picture."
- Step 2: Organize an action plan (worry about details).

Now lets just focus our attention on Scenario 1, where you manage a small firm that manufactures PCs.

Big Picture: Impact of decline in component prices on PC market
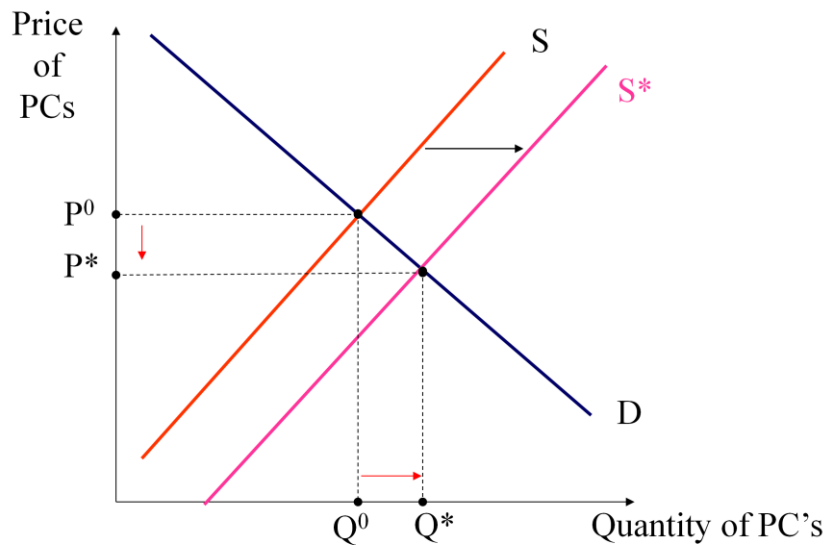
The first thing you do is look at the big picture. You know that if the price of PC's components will fall then your company and others will be able to supply more PCs at the current price. Thus you can increase production. Since you have also done this course you know that this will cause a surplus of PCs at P^0 , causing price to fall to P^*. Thus we will have a new equilibrium at P^* and Q^*. Please note that it is not necessary that the slope of the supply curve will change. Most likely there is just a parallel shift in the supply curve.

Big Picture Analysis: PC Market

- Equilibrium price of PCs will fall, and equilibrium quantity of computers sold will increase.
- Use this to organize an action plan:
  - contracts/suppliers?
  - inventories?
  - human resources?
 - marketing?
  - do I need quantitative estimates?

Now this means that in the PC market the equilibrium price of PCs will fall, and equilibrium quantity of computers sold will increase. You can use this information to come up with an action plan.

Scenario 2: Software Maker

- More complicated chain of reasoning to arrive at the "Big Picture."
- Step 1: Use analysis like that in Scenario 1 to deduce that lower component prices will lead to
  - a lower equilibrium price for computers.
  - a greater number of computers sold.
- Step 2: How will these changes affect the "Big Picture" in the software market?

Now suppose you are a manager of a firm that produces software. You have to ask yourself the question what will happen if the price of PC components goes down?

Big Picture: Impact of lower PC prices on the software market
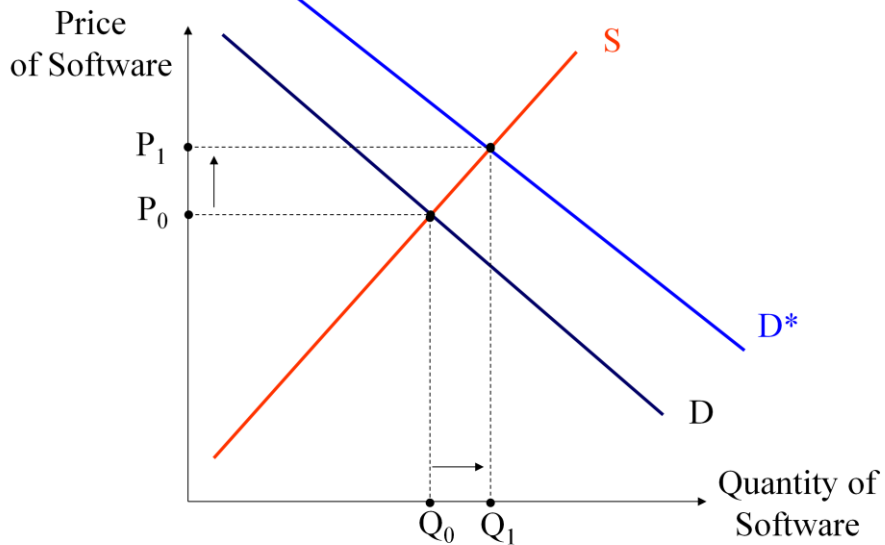
If as a manger you have knowledge of Economics you know that the more PCs will be traded now as opposed to the situation before the change in price of PC components. If people are buying more PCs than before then they need more software. So it is simple the demand of software will increase and demand curve will shift to the right.

Big Picture Analysis: Software Market

- Software prices are likely to rise, and more software will be sold.
- Use this to organize an action plan.

So in the end software prices are likely to rise, and more software will be sold. You can now use this information to construct a action plan for your company.
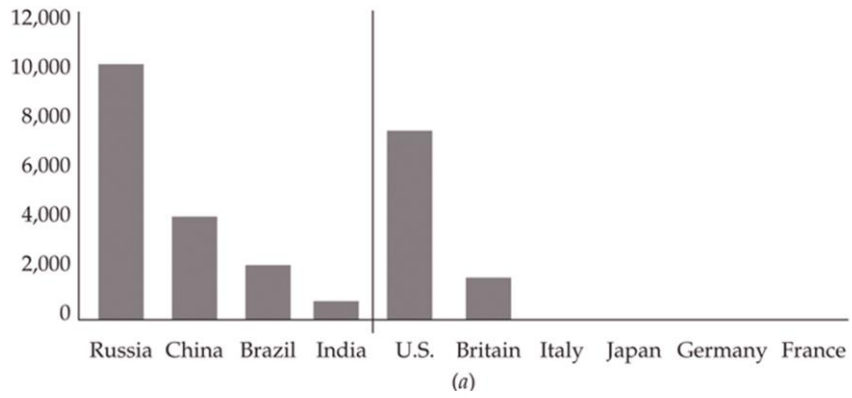
Task

What are the implications of rising demand for oil among developing counties?

This is a topic that affects virtually everyone-it leads to discussions of changes in both supply and demand.
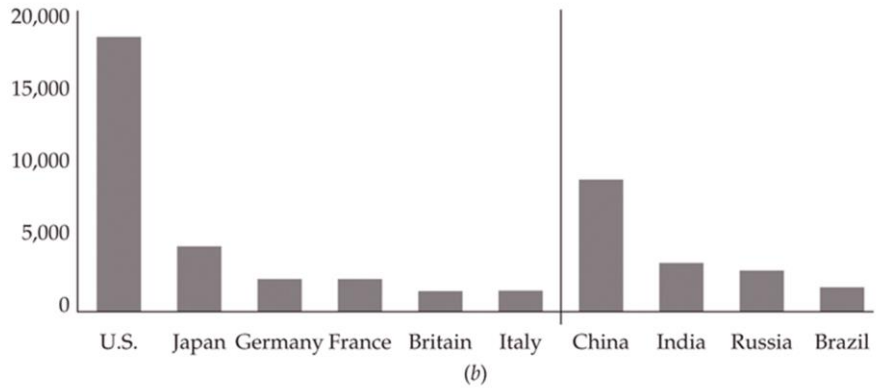
Global Application

Oil production (thousand barrels per day)

Global Application

Oil consumption
(thousand barrels per day)

Task

"While sipping a cup of green tea laced with honey and ginseng. CEO Bob Burns began to reminisce. It seemed like yesterday, but it was actually more than 10 years ago when he had convinced the board of directors of Global foods, Inc . to go into the soft drink business. Here he was a decade later, sampling a product that his VP of Marketing, Nicole Goodman, was telling him would be an even stronger 'growth engine' for the Company than bottled water. She had pointed out to him that in 2003 American consumers spent $5 billion on tea. Although this amount was far less than the $20 billion spent annually for coffee, it was five times as much as people spent on tea a decade ago. 'It's obvious,' she told him, 'Global Foods must get into the tea business.' As he poured his second cup of tea, Bob had to admit that even he had begun to prefer tea over coffee."(Keat and Young 2009, p.45)

What factors must Bob investigate before accepting Nicole's advice?

Conclusion

- The law of demand states that, other factors held constant, the quantity demanded is inversely related to price.
- The law of supply states that, other factors held constant, the quantity supplied is directly related to price.
- Non-price factors may shift the curves.