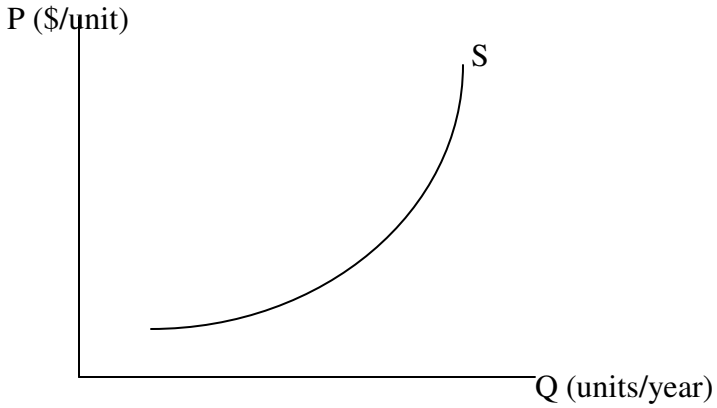
Chapter 2: Basics of Supply and Demand

In this chapter we will review the basics of the supply and demand model and the concept of elasticity. Since these topics should be familiar to you from Econ 201 (and possibly 202), we will move fairly quickly.

Supply and Demand

As you know, the supply and demand model is composed of two parts, a supply curve representing the behavior of sellers and a demand curve representing the behavior of buyers.

The supply curve shows the relationship between the quantity of a good that producers are willing and able to sell and the price of the good (def. from book). Note that the primary relationship here is between the market price P and quantity supplied Q_S. We can represent the supply curve with a graph . . .



. . . or with an equation:

$$Q_S = Q_S(P)$$

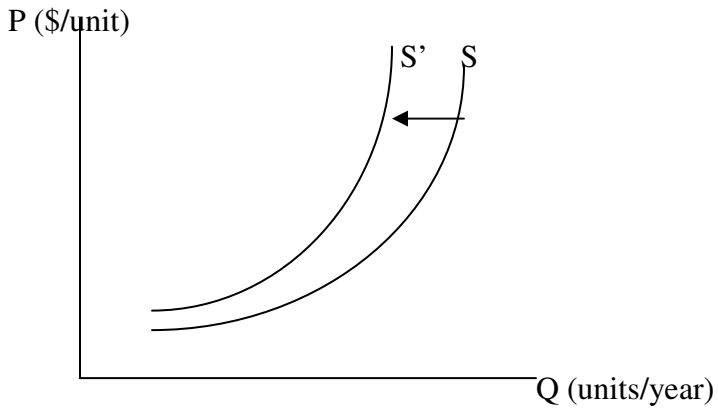
This equation simply states that quantity supplied is a function of P. Note that the supply curve is upward sloping since higher prices make production more profitable and thus encourages firms to expand production. Mathematically, we can therefore write

$$dQ_S/dP > 0$$

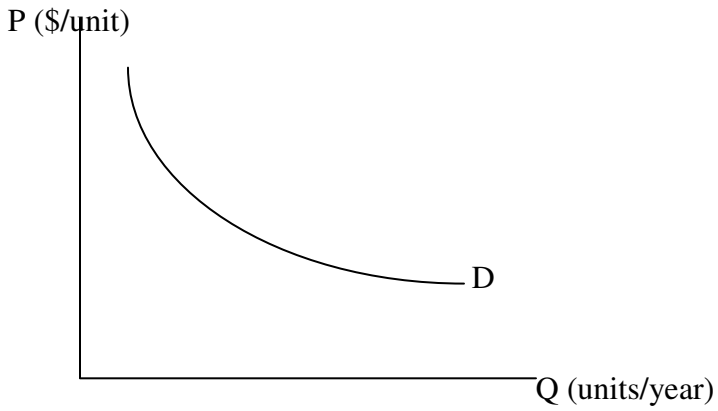
Of course, other variables affect supply besides prices. For example, increases in input prices make it more expensive to produce and thus discourage production. Let W be the wage rate (price of labor). Taking account of this, we can write

$$Q_S = Q_S(P,W) \qquad \text{where } \partial Q_S/\partial W < 0$$

The way to express this graphically is to say that the supply curve shifts to the left (Q_S falls holding P constant) when the wage rises. Notice that when we draw a supply curve, we are implicitly holding W fixed. That is, the supply curve shows the relationship between Q_S and P for a *particular* W; when W changes, our supply curve will change.



The other side of the market is shown by the demand curve, which shows the relationship between the quantity of a good that consumers are willing and able to buy and the price of the good (def. from book). As you know, demand is downward-sloping because as the price of a good rises, it becomes more expensive, making consumers less able to buy it (due to their limited incomes) and less attractive relative to other goods.



Mathematically,

$$Q_D = Q_D(P) \qquad \text{where } dQ_D/dP < 0$$

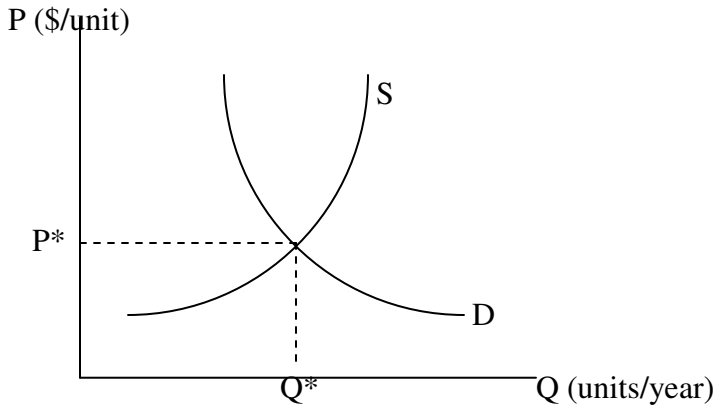
Also, we know that demand depends on other factors besides the good's own price. For instance, the demand for a good may depend on the price of another good, so that

$$Q_D^X = Q_D^X(P^X, P^Y)$$

This equation says that the quantity demanded of good X is a function of the price of good X ("own price") *and* the price of good Y. To make this example more concrete, let's suppose that good X is coffee, and good Y is sugar. In that case, we would expect these two goods to be <u>complements</u>, since they are commonly used together. An increase in the price of a complement (↑ price of sugar) leads to a decrease in quantity demanded for our original good (coffee). Thus, $\partial Q_D^X/\partial P^Y < 0$ if the goods are complements.

<u>Substitutes</u> are goods that are used in place of one another. Suppose that good Y were tea. Since people normally buy either tea or coffee with their breakfast, these goods would qualify as substitutes. As the price of tea rises, coffee looks like a better bargain (consumers demand less tea and thus more coffee). Thus, for substitutes, $\uparrow P^Y \Rightarrow \uparrow Q_D^X$ or $\partial Q_D^X/\partial P^Y > 0$.

We say that our market is in <u>equilibrium</u> when there is no tendency to change. This occurs at the P where $Q_S = Q_D$.



In this diagram, P* and Q* are our equilibrium price and quantity. If $P > P^*$, there would be a surplus, driving P back down. If $P < P^*$, there would be a shortage, which would tend to drive P back up. Only when $P = P^*$ is there no tendency for P (and therefore Q) to change. Also, whenever $P \neq P^*$, the tendency is for P to return to its equilibrium value.

Knowing that the <u>market clearing</u> price occurs at the intersection of supply and demand, we can use our supply and demand model to conduct <u>comparative statics</u> exercises, showing us what happens when something other than own price changes.

Elasticities of Demand and Supply

We can say more about the precise shape of the demand and supply curves beyond the sign of their slope. Elasticity refers to the sensitivity of Q to a change in another variable, and is a commonly used measure of the responsiveness of Q_D and Q_S.

The most commonly used elasticity measure is the (Own) Price Elasticity of Demand (E_P). This refers to the percentage change in Q_D caused by a 1% change in the price of the good itself. It can be written

$$E_P = \%\Delta Q_D / \%\Delta P = (P/Q_D)(\Delta Q_D/\Delta P)$$

or, using calculus instead of Δs,

$$E_P = (P/Q_D)(dQ_D/dP)$$

Demand is said to be elastic when $E_P > 1$ in absolute value, inelastic when $E_P < 1$ and unit elastic when $E_P = 1$.

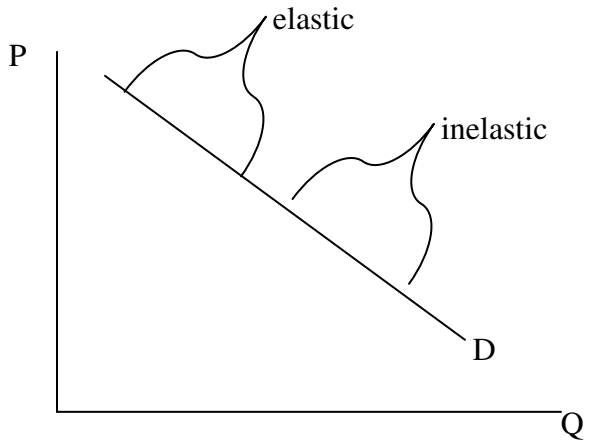
It should be noted that elasticity is not the same as slope, although the two concepts are obviously related. Consider a linear demand curve taking the form

$$Q_D = a - bP$$

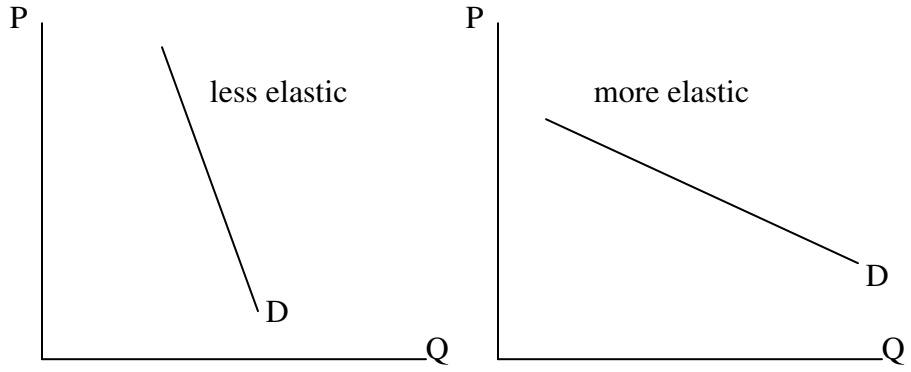
What is the own price elasticity of demand at a point on this curve? Well, $dQ_D/dP = -b$, so $E_P = -b(P/Q)$, which obviously changes depending on the price and quantity.

Suppose that a = 50 and b = 3 as before. Then if P = 10 and Q = 20, $E_P = -1.5$. (Sometimes we take the absolute value so we don't have to deal with negative numbers, but we will follow P&R here) and demand is elastic. However, suppose that P falls to 5 so that $Q_D = 35$. Then $E_P = -3(5/35) = -0.489$ so demand would be inelastic.

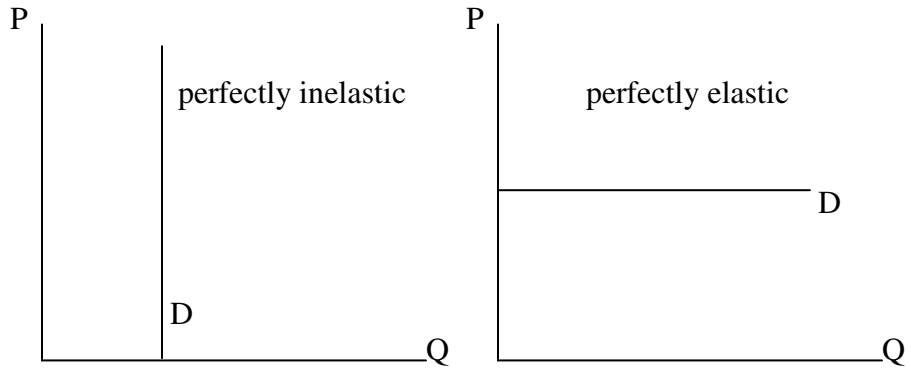
Note that for a linear demand curve, demand tends to be relatively elastic at high prices and relatively inelastic at low prices.



As the demand curve gets steeper, though, dQ/dP gets smaller and E_P becomes smaller, making the curve less elastic.



The extreme cases occur when demand is either vertical or horizontal. When the demand curve is vertical, dQ/dP = 0 and $E_P = 0$, so the demand curve is perfectly inelastic. When the demand curve is horizontal, dQ/dP = ∞ and it is said to be perfectly elastic.



E_P depends on a variety of factors. Demand tends to be relatively elastic when . . .

. . . the good has many close substitutes

. . . consumers can easily do without the good

. . . consumers have more time to respond to a price change

While the own price elasticity of demand is the measure of elasticity that economists refer to most often, the concept of elasticity itself is quite general and can be used in other contexts. Other measures of elasticity include:

Income Elasticity of Demand (E_I): This measure refers to the percentage change in Q_D caused by a 1% change in consumer income. Thus, it can be written

$$E_I = \%\Delta Q_D / \%\Delta I = (I/Q_D)(\Delta Q_D/\Delta I) \quad \text{or} \quad (I/Q_D)(\partial Q_D/\partial I)$$

If $E_I > 0$, this implies that $\uparrow I \Rightarrow \uparrow Q \Rightarrow$ the good is a normal good. If $E_I < 0$, then $\uparrow I \Rightarrow \downarrow Q \Rightarrow$ the good is an inferior good.

Cross-Price Elasticity of Demand (E_{XY}) (notation different from text): Shows the percentage change in Q_D^X caused by a 1% change in the price of good Y.

$$E_{XY} = \%\Delta Q_D^X / \%\Delta P^Y = (P^Y/Q_D^X)(\Delta Q_D^X/\Delta P^Y) \quad \text{or} \quad (P^Y/Q_D^X)(\partial Q_D^X/\partial P^Y)$$

If $E_{XY} > 0$, goods X and Y are substitutes. They are complements if $E_{XY} < 0$.

(Own) Price Elasticity of Supply (E_S) = $\%\Delta Q_S / \%\Delta P = (P/Q_S)(\Delta Q_S/\Delta P) = (P/Q_S)(dQ_S/dP)$