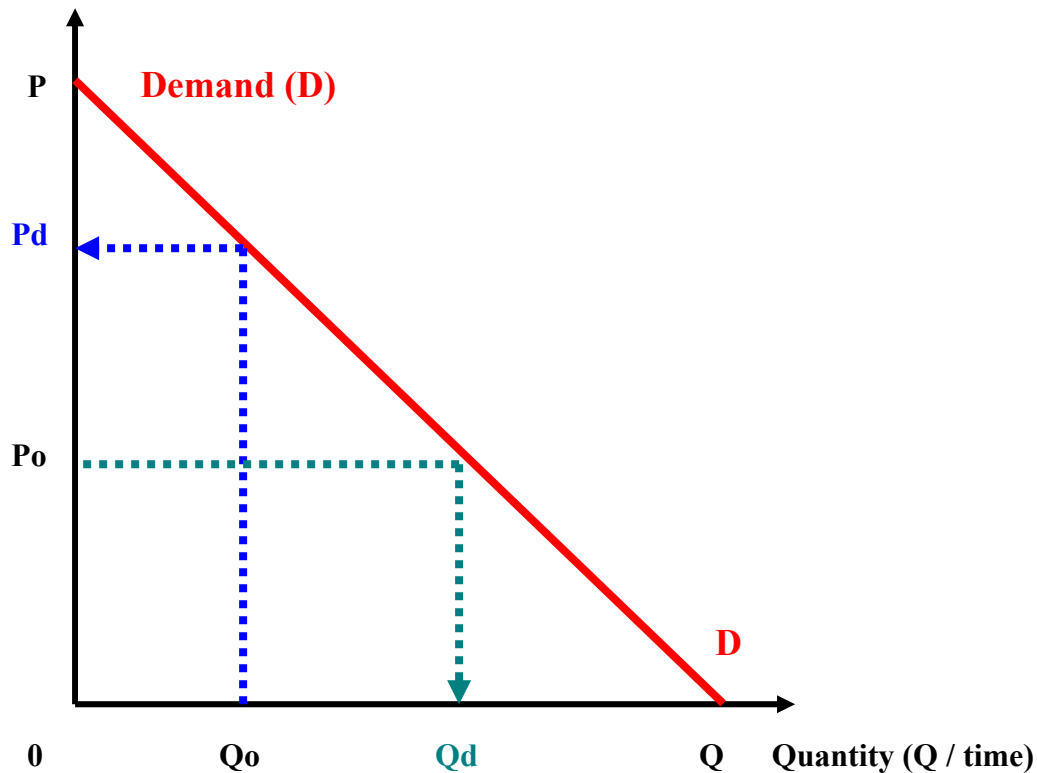


## DEMAND AND SUPPLY CURVES: CONSUMER & PRODUCER SURPLUS

by Kenneth Matziorinis

Price (P / Q)



**FIGURE 1.1  
THE DEMAND CURVE**

### The Demand Curve and the Law of Demand

The demand curve shows the maximum price an individual or the market is willing and able to pay to buy an additional unit of a product from the first, to the second all the way to the last unit. The maximum price an individual is willing to pay for a given quantity ( $Q_0$ ) is called the demand price ( $P_d$ ). The maximum amount that an individual is willing and able to buy at a given price ( $P_0$ ) is called the quantity demanded ( $Q_d$ )

The area bounded by the triangle  $OPQ$  represents the value or the benefit an individual or the market receives by consuming the product. Why? When we need something, we are willing to pay for it. As long as the price we pay (the value of money we exchange) for a given amount of the product we demand is less than the value (benefit) we receive, we buy it. If it is more, we don't buy it. Would you pay for something you don't need?

The total value or benefit we receive when we consume a product for free is calculated as follows:

$$\text{Value of Product} = \frac{\text{OP} \times \text{OQ}}{2} = \text{The area of the triangle OPQ}$$

The demand curve is not necessarily always a straight line, it can be curved as well. Here we draw it as a straight line for convenience of presentation and mathematics.

The demand curve is downward sloping, i.e. it has a negative slope. Why? Because when you need something badly, you are willing to pay more for it. If you satisfy some of your need, then you don't need it as much and therefore are not as willing to pay the same price any more. The more of a product we consume, the more satiated we become and therefore the less we are willing to pay for it. Thus, as the quantity consumed increases, the price we are willing and able to pay decreases, and vice versa of course. This fundamental relationship between our needs and the sacrifice we are willing to make to meet them is called in economics the **law of demand**, and is one of the fundamental laws of economic behaviour.

More technically, the **law of demand is defined as the inversely proportional relationship between the price of the product and the quantity demanded of that product, all other factors remaining constant.**

### Determinants of Demand: Changes in Demand vs. Changes in the Quantity Demanded

But what determines demand? The demand for a product is derived from our needs. If you find that a product fulfills your needs, then you will demand it. But how much you will demand also depends on i) how much of it you desire to satiate your needs which economists refer to as our tastes and preferences (T&P); ii) the income you earn or the money you have available to pay for it (I); iii) the price of related products that can satisfy more or less the same need, which are called substitutes or competing products (Ps); iv) the price of related products that you use in conjunction with this product which are called complements (Pc); v) our expectations of what the future will bring, for example if you expect you will need more (or less) of the product tomorrow, if you expect to earn more (or less) tomorrow, if you expect the price of substitutes or complements to rise or fall tomorrow, which economists call expectations (E); vi) the number of consumers in the market (N) and vii) of course any other factors (O) such as seasons, weather, laws, regulations, among others.

The various factors or determinants of demand are called the **demand determinants** or the **demand function** and presented as follows:

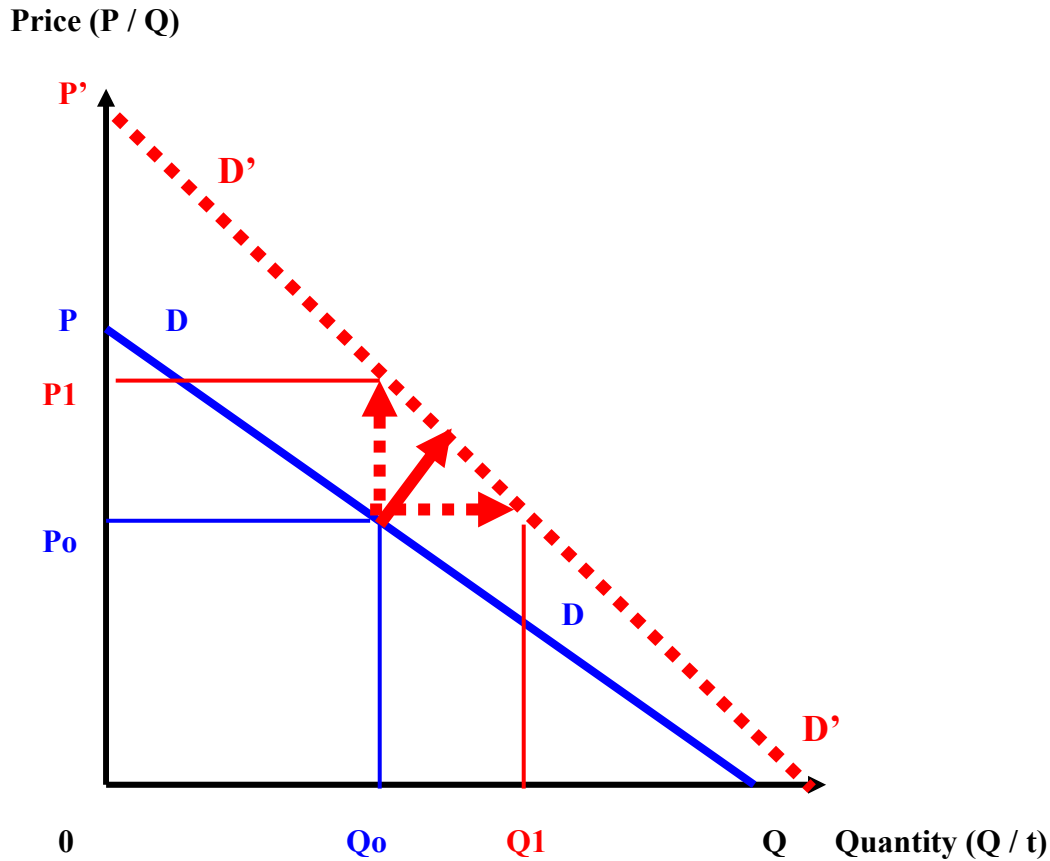
$$\text{Demand (DD)} = f ( \text{T\&P, I, Ps, Pc, E, N, O} )$$

All the factors that determine the demand for a product either at the individual level or the market (group) level determine the position and slope of the demand curve shown in **Figure 1-1** above.

Note, that the market price of the product (P) does not determine the demand for the product, but the quantity that we will buy and is called the quantity demanded (Qd) and is the maximum amount that we are willing and able to buy at the prevailing price. Given our demand for the product, we will find that we buy more when the price is low and less when the price is high. This is the inverse relationship that we referred to earlier which is called the law of demand. Thus,

$$\text{Qd} = f ( \text{P} ), \text{ where } (\Delta\text{Qd} / \Delta\text{P} < 0)$$

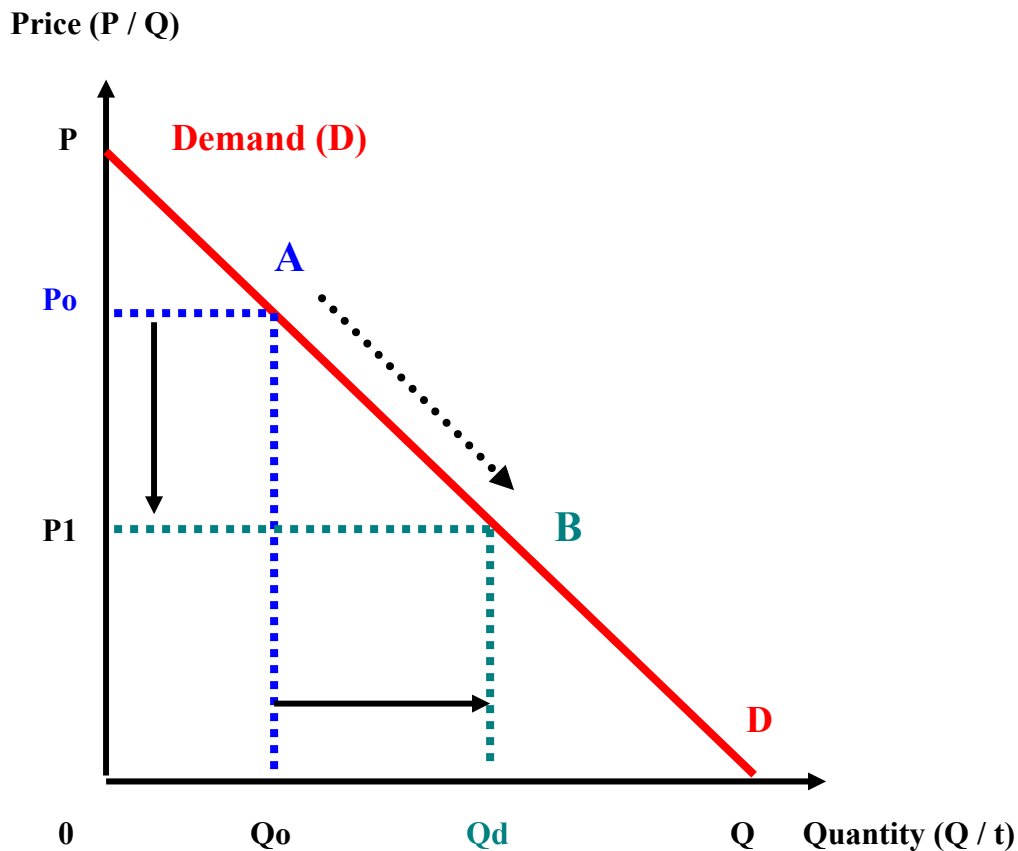
Now, what happens when any one of the demand determinants changes, say a rise in our income or a strengthening in our tastes or preferences for the product? What happens is that the demand increases, that is a) we are willing and able to pay a higher price to buy the same amount, which raises the demand price ( $P_d$ ) or b) we are willing and able to buy a larger amount of the product at the same price which raises the quantity demanded ( $Q_d$ ) or most likely, c) a combination of the above. When there is a change in demand, the whole demand curve shifts out or shifts in, and the slope is likely to change as well. **Figure 1-2** illustrates what happens when the demand increases:



**FIGURE 1-2**  
**A CHANGE IN THE DEMAND FOR A PRODUCT AND**  
**A SHIFT IN THE DEMAND CURVE**

When demand increases the demand curve shifts from  $DD$  to  $D'D'$ . This means that at the original price ( $P_0$ ) people buy a larger amount than before ( $Q_1$  vs.  $Q_0$ ) or at the original amount ( $Q_0$ ) people become willing to pay a higher price ( $P_1$  vs.  $P_0$ ) than before, or a combination of the two. When any of the demand determinants change they cause rightward or leftward **shifts** in the whole demand curve, and these changes are referred to us **an increase** or a **decrease in demand**. We refer to them as changes in the demand for the product as opposed to changes in the quantity demanded ( $Q_d$ ) which is an expression used to describe what happens when the price changes, but the demand remains the same.

Now, let us describe and illustrate what happens when the price is changing, but the demand remains the same (constant). When the price is changing, it does not affect our demand for the product, it only affects the amount that we will choose to buy at that price. In other words, we say that it will affect the quantity demanded ( $Q_d$ ) as opposed to the demand. **Figure 1-3** illustrates the effect. When the price falls for example from  $P_0$  to  $P_1$ , all other factors remaining constant, the quantity demanded will increase from  $Q_0$  to  $Q_1$ . The demand stays the same, but we move from one point (A) on the demand curve to another point (B) and we refer to this adjustment as a **movement along the demand curve**.



**FIGURE 1.3**  
**A CHANGE IN THE QUANTITY DEMANDED AND**  
**A MOVEMENT ALONG THE DEMAND CURVE**

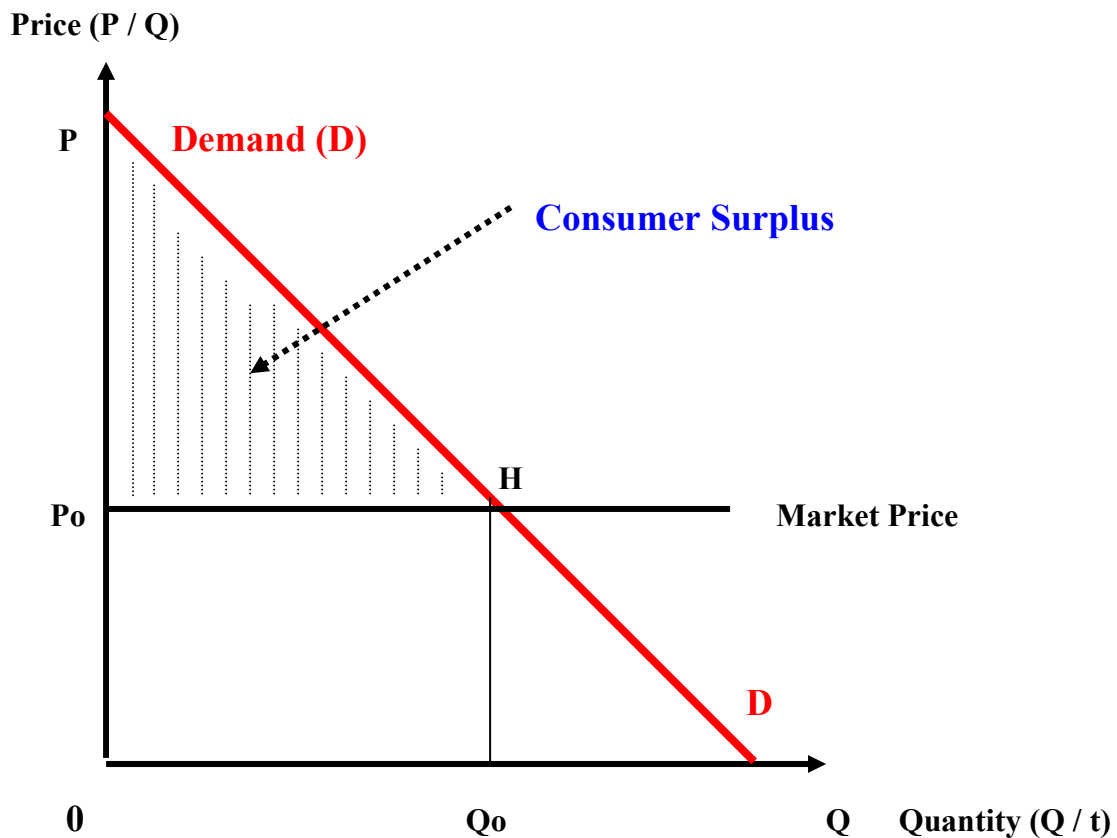
Let's summarize here once more.

- When there is a change in any factor (except the price) it results in a **change in demand** and a **shift in the demand curve**.
- When there is a change in the price of the product, but no change in any other factor, it results in a **change in the quantity demanded** and a **movement along the demand curve**.

## Consumer Surplus

Consumer surplus is the “profit” we make when we exchange money for goods and services. It is the difference between the maximum price we are willing and able to pay –which is a measure of how much a product is worth to us or how much we benefit by consuming it- and the price we pay for it –which is a measure of how much we have to give up or sacrifice to get it.

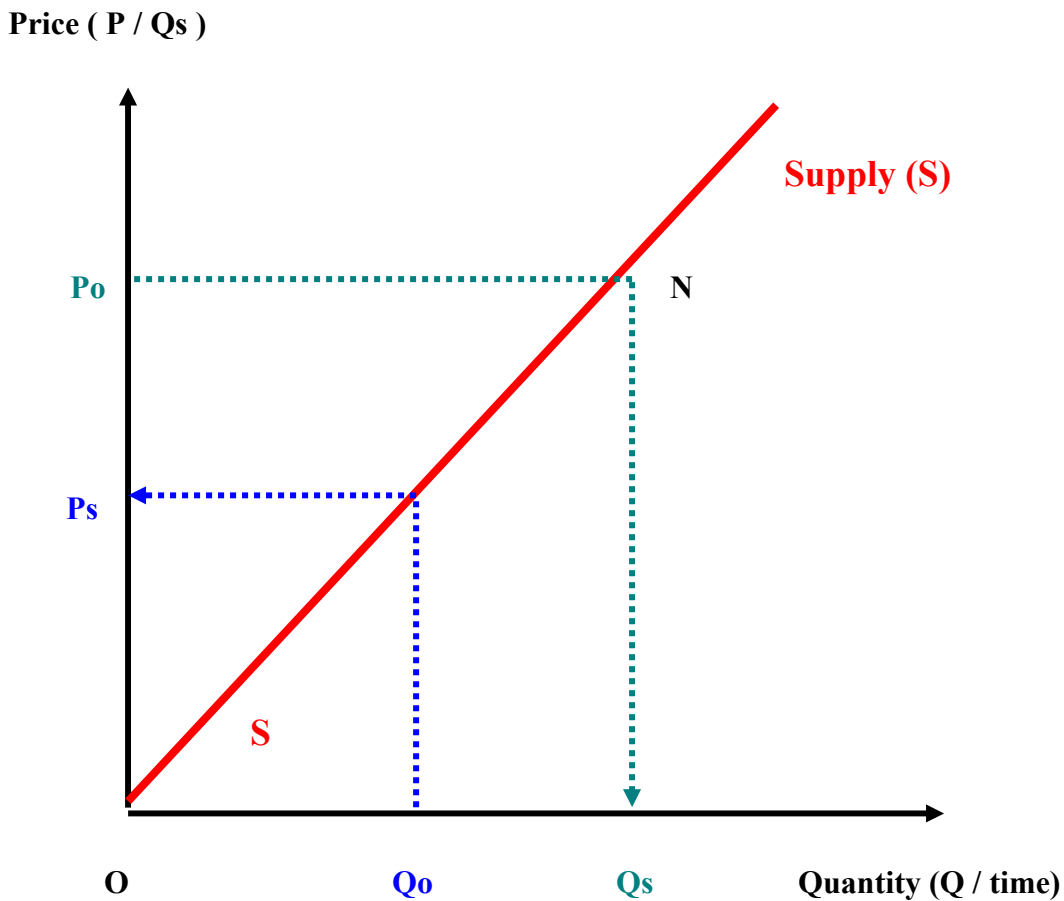
When a product is free, i.e.  $P = 0$ , the total benefit or utility derived from consuming it is given by the area of the triangle  $OPQ$ . If the product costs money to produce and we have to pay a price, we will not buy the maximum amount  $Q$ , but less. What determines how much we buy is the trade-off between the benefit each additional unit consumed provides us and the cost of buying an additional unit. In **Figure 1-4** below, the last unit we are willing to buy is  $Q_0$ , also shown as point  $H$  where the additional benefit just covers the additional cost of procuring it. Thus the total benefit received is given by the area of the trapezoid  $OPHQ_0$  while the monetary cost of procuring it is given by the area of the rectangle  $OP_0HQ_0$ . The profit we make by buying the product is the difference between the area of the trapezoid and the rectangle, and is called the **consumer surplus**. Graphically, it is illustrated as the area inside the demand curve formed by the triangle  $P_0PH$ .



**FIGURE 1.4**  
**CONSUMER SURPLUS : THE GAIN FROM MARKET EXCHANGE**

## The Supply Curve and the Law of Supply

The supply curve shows the minimum price a producer or the industry is willing and able to accept to produce an additional unit of a product from the first, to the second all the way to the last unit. The minimum price a producer is willing and able to accept to produce a given quantity ( $Q_0$ ) of a product is called the supply price ( $P_s$ ). The maximum amount that an individual is willing and able to produce at a given price ( $P_0$ ) is called the quantity supplied ( $Q_s$ ). If someone asks you to produce amount  $Q_0$  for a price less than  $P_s$ , you will refuse. If someone offers to pay you more than  $P_s$  to produce  $Q_0$ , you will gladly do so, because they are offering you more money than the amount you are willing and able to work for. If they offer to pay you  $P_s$ , the amount you are just willing to produce, you will just take the job if you have no better offer available. Likewise, if the price is given at  $P_0$ , the fundamental question you need to ask is what is the most of the product you are willing and able to produce at that price without losing money or incurring an opportunity loss.



**FIGURE 1-5**  
**THE SUPPLY CURVE**

The area bounded by the triangle  $ONQ_s$  represents the cost or the sacrifice the producer incurs including the opportunity cost of producing  $Q_s$  amount of the product. Why? To produce anything it involves costs and effort. We don't produce anything unless the rewards justify the

costs of doing so. If the rewards exceed the cost of the effort, we produce, if the costs exceed the rewards, we don't. Would you work for nothing?

The total cost of producing a product is calculated as follows:

$$\text{Cost of Product} = \frac{OP_o \times OQ_s}{2} = \text{The area of the triangle } ONQ_s$$

The supply curve is not always a straight line, it can be curved as well and is not always upward sloping either. Here we present it as a straight line for convenience of presentation and mathematics.

In the short-run, the supply curve is upward sloping, i.e. it has a positive slope. Why? Because in the short-run some of your production inputs like the space you use, your production facility, machinery and equipment (known as fixed inputs) are in fixed supply and it takes considerable time to enlarge them. If you need to expand production, you can increase the amount of some inputs you use such as labour, materials and energy (known as variable inputs) but you cannot do the same with your fixed inputs, thus you are forced to stretch your limited resources, which reduces their efficiency and raises your cost of production. The more of the product you try to produce, the more it starts to cost you and therefore the less willing you become to produce it. Thus, to make the effort to supply more you need an incentive, the incentive of a higher price that will compensate you for the extra cost you are making. This fundamental relationship between our need to be rewarded for the extra cost and effort we incur to produce a product is called the **law of supply**, and is one of the fundamental laws of economic behaviour. The greater the reward for our effort the more willing and able we produce and supply the product.

More technically, the **law of supply is defined as the directly proportional relationship between the price of the product and the quantity supplied of that product, all other factors remaining constant.**

### **The Determinants of Supply: Changes in Supply vs. Changes in the Quantity Supplied**

But what determines supply? The supply of a product depends on the available production technology and resources and our willingness to deploy them to supply the product. How much of a product we will supply in the short-run depends on the following factors: i) the production technology available to produce the product (Tech), e.g. a farmer using modern agricultural techniques such as fertilizer, tractors and harvesters can produce more than a farmer using traditional techniques employing a cow and a plough driven by hand; ii) the price (cost) of the resources needed to produce the product (Pr), e.g. the price of labour (wage rate), the price of capital (interest rate), the price of land (rent) the price of raw materials, the price of energy, the price of capital goods (machinery and equipment), among others; the higher the price of these resources the less your ability to produce; iii) the goals of the producer, i.e. whether you want to maximize profit or sales or a combination of goals; iv) the price of other products that you can produce using the same technology and resources, e.g. a farmer can use the same land and resources to grow wheat, oats, corn, barley, hey, soybeans or other crops, which one he will grow will depend on how much he will earn, if the price of corn is higher than the price of wheat, he will switch production from wheat to corn, so as the price of corn rises, you will find the production of wheat will fall; v) the expectations of producers (E) regarding the future

price of the product or related products, the price of resources, etc. vi) the number of producers or production establishments (N) in the industry, e.g. the more car assembly plants there are the greater the supply of cars will be; and finally vii) all other factors (O), such as weather, taxes, government rules and regulations, strikes, supply disruptions due to natural disasters, among others.

The various factors or determinants of supply are called the **supply determinants** or the **supply function** and presented as follows:

$$\text{Supply (SS)} = f ( \text{Tech, Pr, G, Po, E, N, O} )$$

All the factors that determine the supply of a product either at the individual level or the industry (group) level determine the position and slope of the supply curve shown in **Figure 1-5** above.

Note, that the market price of the product (P) does not determine the supply of the product, but the quantity that will be produced and is called the quantity supplied (Qs) and is the maximum amount that we are willing and able to supply (produce) at the prevailing price. Given our supply for the product, we will find that we supply less when the price is low and more when the price is high. This is the directly proportional relationship that we referred to earlier which is called the law of supply. Thus,

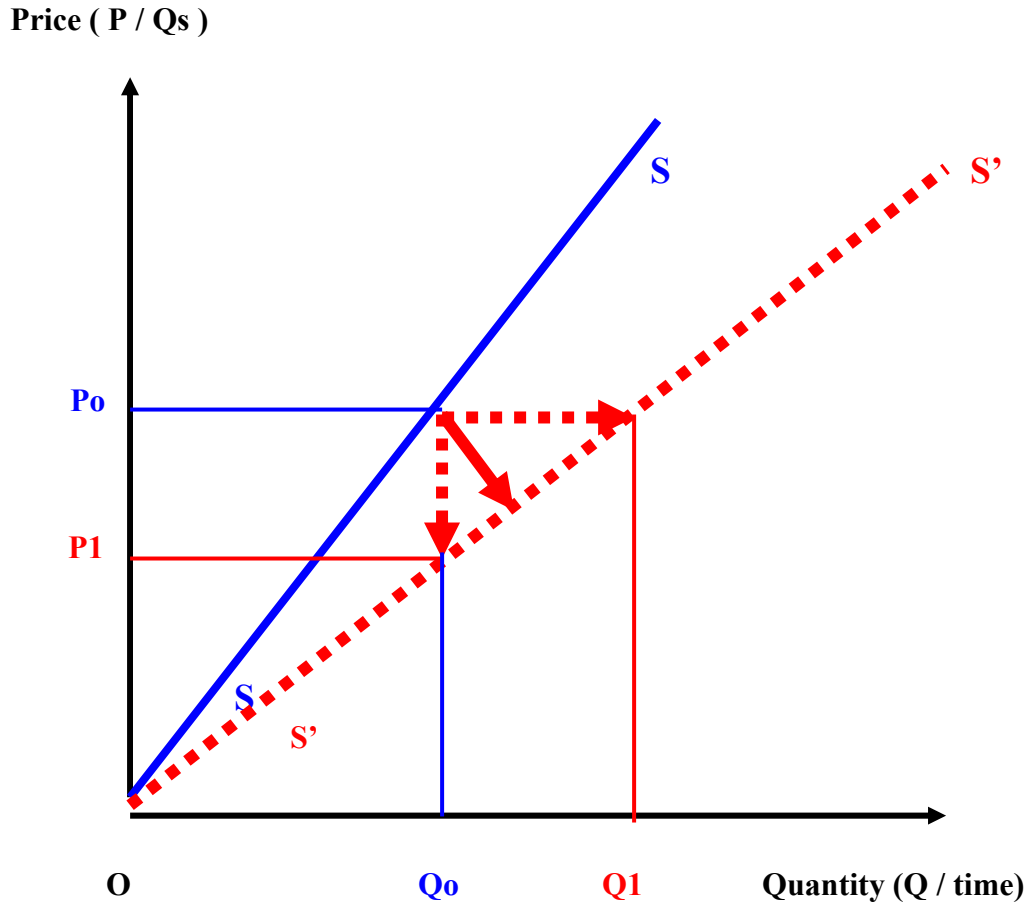
$$Q_s = f ( P ), \text{ where } (\Delta Q_d / \Delta P > 0)$$

Now, what happens when any one of the supply determinants changes, say a fall in the price of resources or an improvement in the state of production technology? What happens is that the supply will increase, that is a) we are willing and able to produce at a lower price than before, which lowers the supply price (Ps) or b) we are willing and able to produce a larger amount of the product at the same price which raises the quantity supplied (Qs) or most likely, c) a combination of the above. When there is a change in supply, the whole supply curve shifts out or shifts in, and the slope is likely to change as well. **Figure 1-6** illustrates what happens when the supply increases:

When supply increases the supply curve shifts from SS to S'S'. This means that at the original price (Po) producers are able and willing to supply a larger amount than before (Q1 vs. Qo) or at the original amount (Qo) producers are able and willing to produce at a lower price (P1 vs. Po) than before, or a combination of the two. When any of the supply determinants change they cause rightward (down) or leftward (up) **shifts** in the whole supply curve, and these changes are referred to us **an increase** or a **decrease in supply**. We refer to them as changes in the supply of the product as opposed to changes in the quantity supplied (Qs) which is an expression used to describe what happens when the price changes, but the supply remains the same.

Please note that a rise in supply is illustrated by the shift in the supply to the right or down. Don't confuse it with a shift up (shift to the left) which represents a decrease in supply!

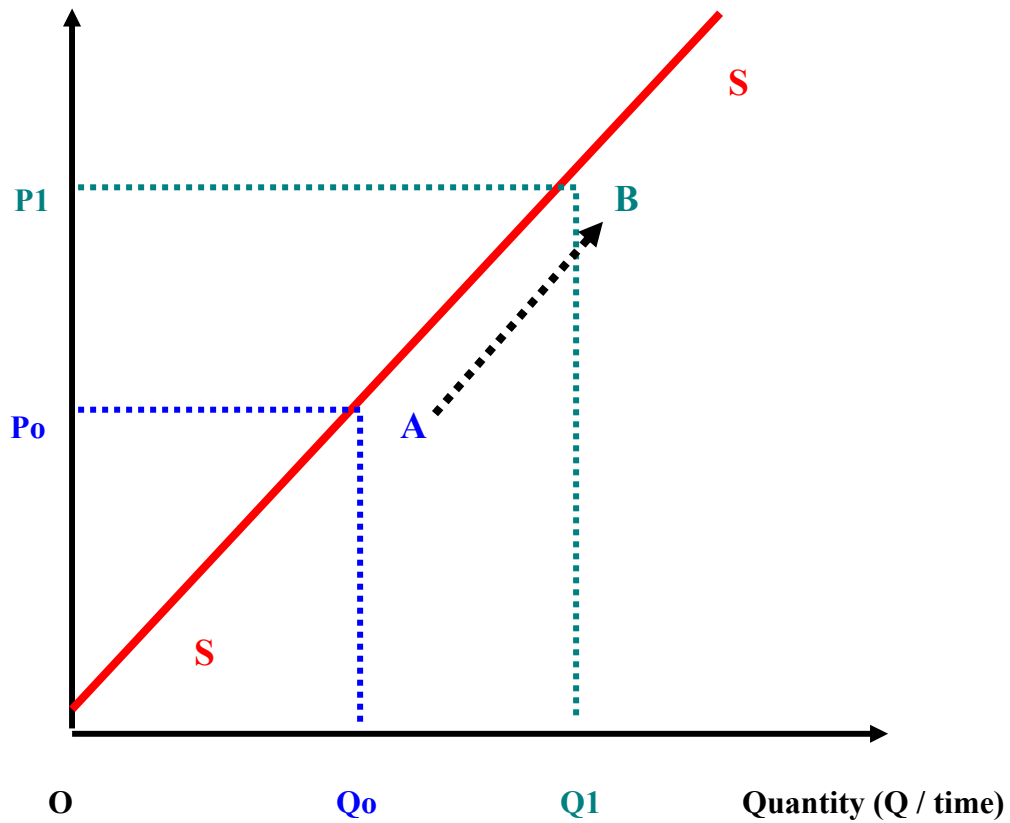




**FIGURE 1-6**  
**A CHANGE IN THE SUPPLY OF A PRODUCT AND**  
**A SHIFT IN THE SUPPLY CURVE**

Now, let us describe and illustrate what happens when the market price is changing, but the determinants of supply remains the same (constant). When the price is changing, it does not affect the supply of the product, it only affects the amount that we will choose to produce at that price. In other words, we say that it will affect the quantity supplied (Qs) as opposed to the supply. **Figure 1-7** illustrates the effect. When the price rises for example from P<sub>0</sub> to P<sub>1</sub>, all other factors remaining constant, the quantity supplied will increase from Q<sub>0</sub> to Q<sub>1</sub>. The supply remains the same, but we move from one point (A) on the supply curve to another point (B) and we refer to this adjustment as a **movement along the supply curve**.

Price (  $P / Q_s$  )



**FIGURE 1-7**  
**A CHANGE IN THE QUANTITY SUPPLIED AND**  
**A MOVEMENT ALONG THE SUPPLY CURVE**

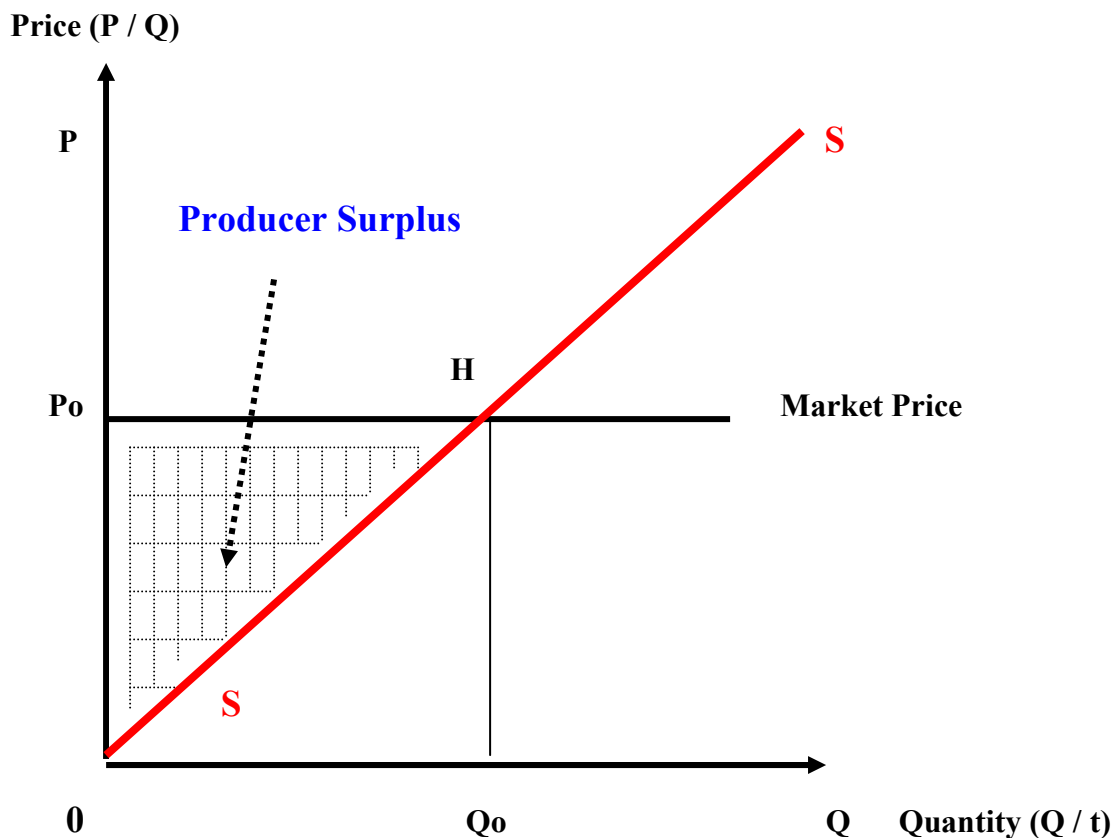
Let's summarize here once more.

- When there is a change in any factor (except the price) it results in a **change in supply** and a **shift in the supply curve**.
- When there is a change in the price of the product, but no change in any other factor, it results in a **change in the quantity supplied** and a **movement along the supply curve**.

## Producer Surplus

Producer surplus is the “profit” the producer makes when he exchanges goods and services for money. It is the difference between the market price the product is sold for and the minimum price the producer is just able and willing to work for and produce and supply the product. For example, if you are willing to take on a job for \$10.00 an hour (you would refuse the job at a rate less than that) , but the employer offers to pay you \$15.00 an hour, the \$5.00 difference between what you are paid the and minimum price you are willing to accept to do the job is what the producer surplus is all about. In economics, we also call it “economic rent”

**Figure 1-8** below illustrates the concept of producer surplus or economic rent. The area inside the triangle OHQo represents the cost of producing Qo amount of the product including a normal profit sufficient to motivate the producer to undertake the production. If the market price is Po, the maximum amount that the producer will be able and willing to supply is Qo. The area inside the triangle OPoH on the other hand represents the excess between the price received by the producer to supply the product and the minimum price he is prepared to accept to produce it for and represents the **producer surplus**. Thus, producers enjoy a monetary gain when the market price for their product exceeds the minimum price they are willing to work for it.



**FIGURE 1.8**  
**PRODUCER SURPLUS : THE GAIN FROM MARKET EXCHANGE**

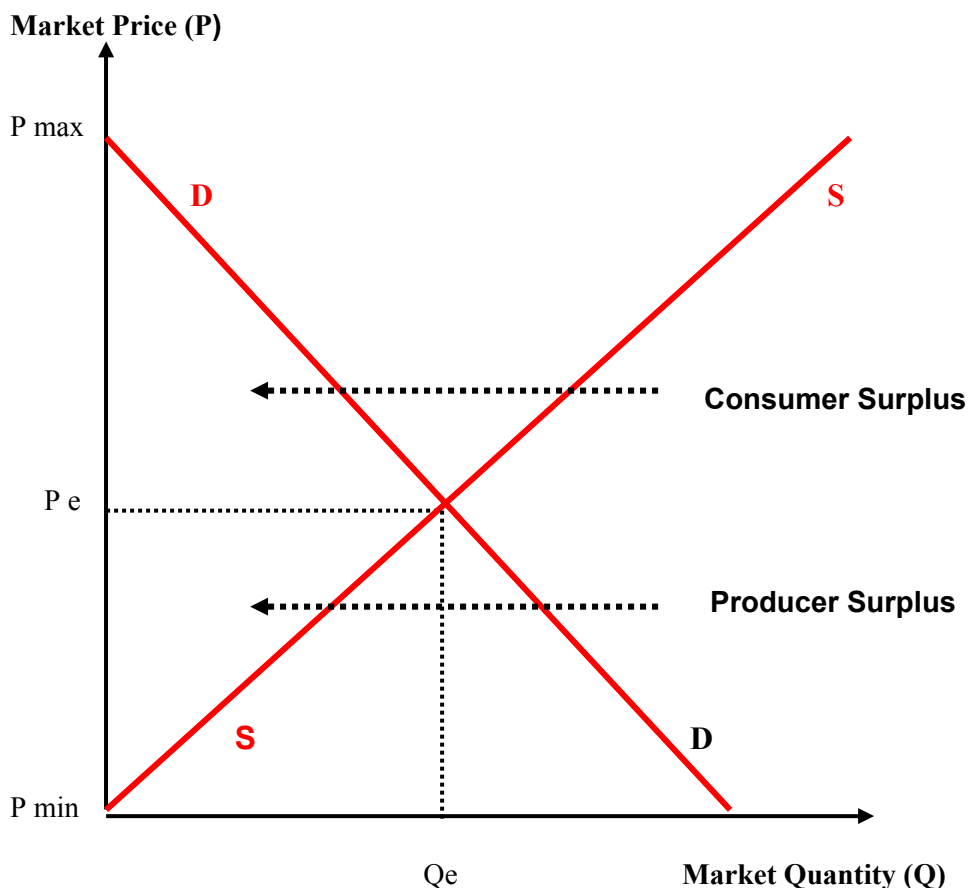
## Consumer and Producer Surplus and the Market

We learned above that consumer surplus is the amount that consumers benefit when they are able to purchase a product at a price that is less than the most that they would be willing and able to pay. Producer surplus is the amount that producers benefit by selling at a market price that is higher than the least that they would be able and willing to sell for. While consumer surplus accrues to the consumers of the product, producer surplus accrues to the owners of the factors of production. The concept of producer surplus is closely related to the concept of economic rent which is the difference between the amount you earn and the amount that would be just sufficient to persuade you to provide your resource, say land or labour. A good example of a product with a high consumer surplus is drinking water. The price we are willing to pay for it is well in excess to the price at which it is offered. The money we save by not having to pay the price it is worth to us is what consumer surplus is all about.

When we engage in production, we benefit both as consumers and as producers. The total benefit which we also called welfare of society is the sum of the consumer and producer surpluses and we calculate it as follows:

$$\text{Total Welfare} = \text{CS} + \text{PS}$$

$$\text{Where CS} = \frac{1}{2} Q_e (P_{\max} - P_e) \text{ and } \text{PS} = \frac{1}{2} Q_e (P_e - P_{\min})$$

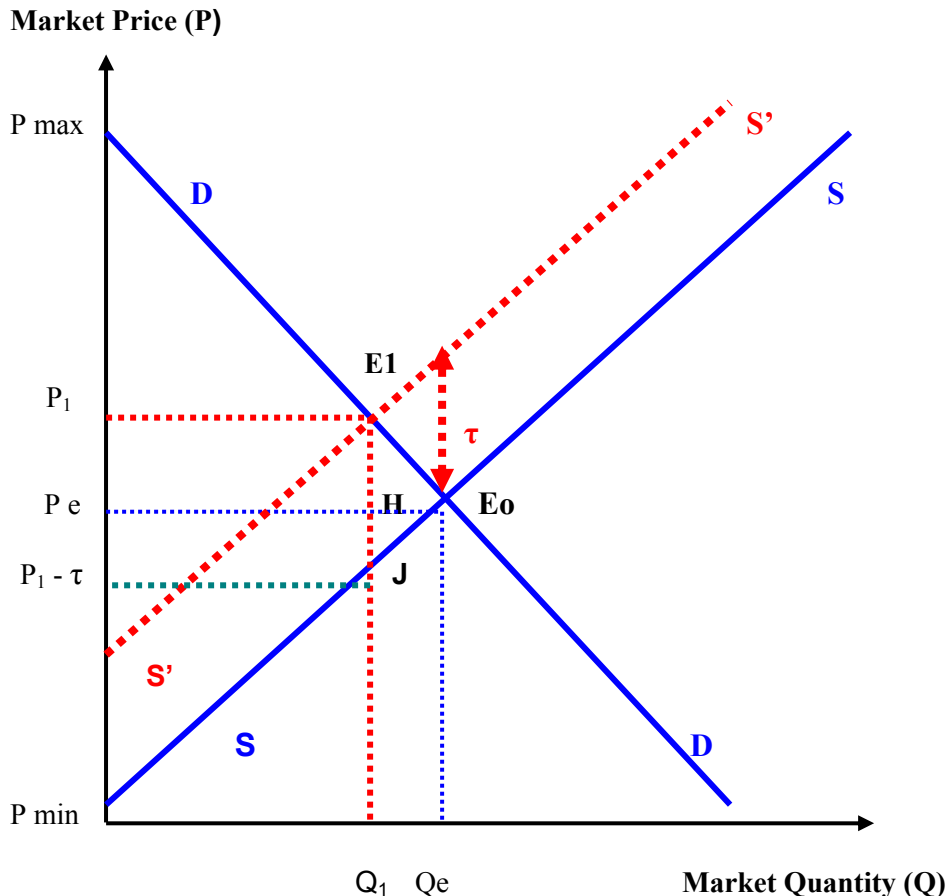


**FIGURE 1.9**  
**TOTAL WELFARE GAIN: CONSUMER PLUS PRODUCER SURPLUS**

## The Effect of a Tariff on Societal Welfare

A **tariff** is a tax on the the importation of a product from another country. It is also called a **customs duty**. Tariffs were initially introduced to raise revenue for a government. Later on, governments realized that they could set higher tariffs in order to discourage imports and thereby provide protection for domestic producers, thus they became important instruments of trade protectionism. There are two types of tariffs: a) **ad-valorem** duties, a tax calculated as a percent (e.g. 10%) of the value of what is imported and b) **excise** duty, a tax set at a fixed dollar amount, e.g. \$4.00 per unit imported into the country. The economic effects of both types of tariffs are the same, but using excise duties makes the illustration a little simpler.

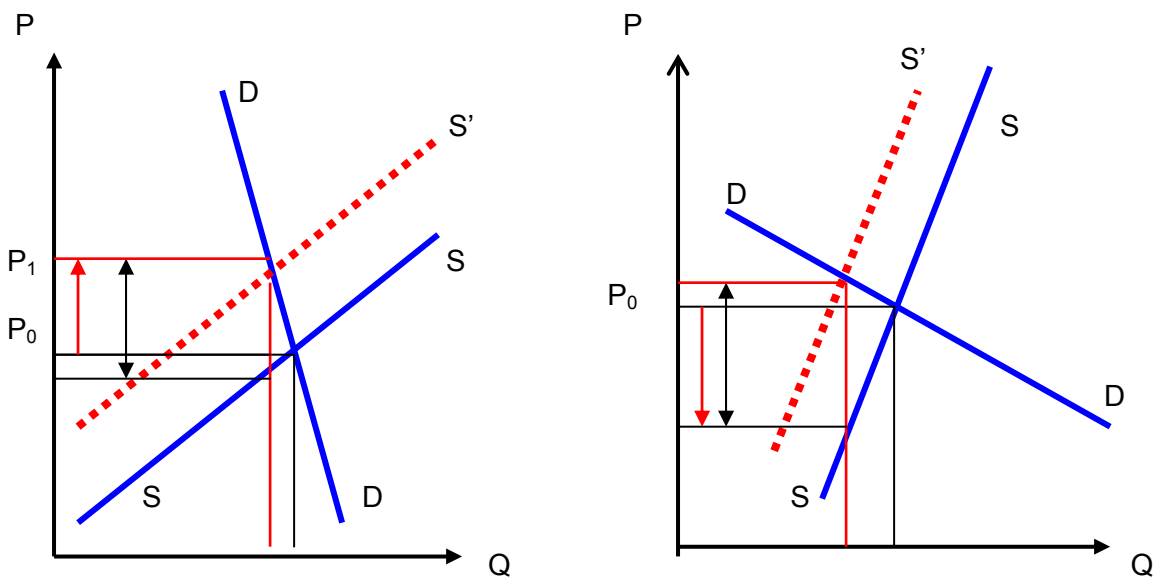
Now, let us examine the economic effects of levying an excise duty on the importation of a product. If the government sets an excise duty of  $\tau$  on a product, it is applied to the supply of the product which raises the supply price ( $P_s$ ) by the amount of the tax. This shifts the supply curve up or to the left of where it was before ( $S'S'$ ), thereby lowering the supply of the product. Given the demand for that product, the equilibrium quantity exchanged will fall to  $Q_1$ , as fewer consumers will afford the product and raises the equilibrium market price to  $P_1$ .



**FIGURE 1-10**  
**THE EFFECT OF A TARIFF ON SOCIETY**

As you can see from **Figure 1-10**, the implementation of an excise tariff, will reduce the consumer surplus by an amount equal to the area of the trapezoid  $P_e P_1 E_1 E_o$  and reduce the producer surplus by an amount equal to the area of the trapezoid  $P_e E_o J P_1 - \tau$ . Consumers will end up paying more per unit and buying fewer units, producers will sell fewer units and receive a price net of the duty which will be lower than before. A tariff reduces the welfare of both consumers and producers. On the other hand, the government benefits from the newfound flow of revenue, equal to the area of the rectangle  $P_1 E_1 J P_1 - \tau$ . Since the government benefits both consumers and producers, the welfare gain for the government offsets most of the welfare lost by consumers and producers. But if you look closely to **Figure 1-10**, not all of the loss is offset. There is still a net loss of welfare for the whole society equal to the small triangle  $E_1 E_o J$ . This net loss in societal welfare is called **deadweight loss**. It means that there are people who were not able or willing to pay the higher price which includes the duty and as a result are obliged to go without consuming this product. This reduces the overall welfare of society.

In Figure 1-10, the impact of the tariff was more or less equal on both consumers and producers. This is not always the case. Who absorbs most of the impact also depends on who needs to engage in trade the most. For example, if the product is considered a necessity for the consumer, they will still buy it even if they are forced to pay more for it, while the producer, will absorb less of the cost of the tariff. Likewise, if the product is considered a luxury by the consumer, he will shy away from purchasing it at the higher price and the producer will be forced to absorb most of the cost of the tariff. Thus, the differential effect of a tariff also depends on the price elasticity (sensitivity) of buyers (demand) and sellers (producers or importers). **Figure 1-11** below illustrates the differential effect of tariffs on buyers and sellers.



Here the consumer absorbs most of the customs duty – the demand is steep (inelastic) the supply is flat

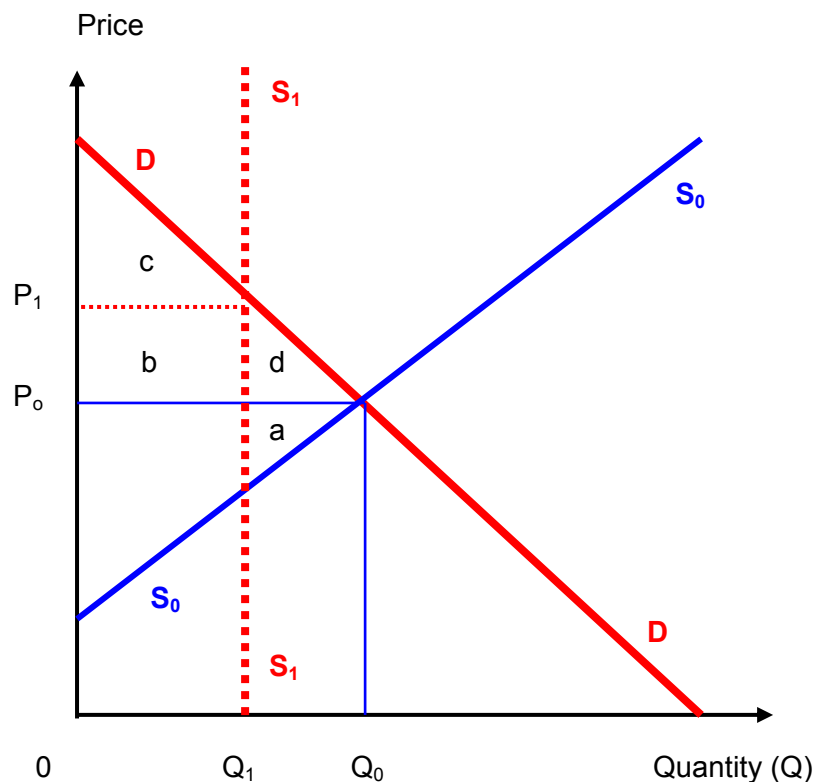
Here the producer absorbs most of the custom duty – the demand is flat (elastic), the supply is steep

**FIGURE 1-11**  
**THE DIFFERENTIAL EFFECT OF A TARIFF DEPENDING ON THE ELASTICITY OF THE DEMAND OR SUPPLY OF THE PRODUCT**

### The Effect of a Quantitative Restriction or Quota on Imports

Another way to reduce imports and protect the domestic producers is the imposition of a quota. A **quota** is a limit on the amount of a good that can be imported in a country. Quotas are also known as **voluntary restraint arrangement (VRA)** or **voluntary export restraint (VER)** because the importing country either limits unilaterally or asks the exporting country to reduce the amount it exports to the importing country voluntarily.

Let us examine the economic effects of a quota on the domestic market for a product. The implementation of a quota has the effect of replacing the initial market supply ( $S_0S_0$ ) by a new supply  $S_1S_1$ , the result of the limit on how much can be imported into the country. The market price now rises to  $P_1$  and the quantity exchanged falls to  $Q_1$ . As a result, consumer surplus is reduced considerably from the area  $(c+b+d)$  to the area  $(c)$ . Producer surplus is reduced by the area in triangle  $a$ , but is more than compensated for by the addition of the area in rectangle  $(b)$ . Thus, consumer surplus is reduced by areas  $(b+d)$  while producer surplus is raised by areas  $b$  less area  $a$  ( $b-a$ ). The net deadweight loss to society is the sum of triangles  $(a+d)$ . Since a quota is not a tax, the government receives no benefit whatsoever in the form of higher revenues.



**FIGURE 1-12**  
**THE ECONOMIC EFFECTS OF A QUOTA ON CONSUMER, PRODUCER AND SOCIETY**

It can be seen from the above, that the distributional effects on society of a quota are very different from those of a tariff. With a quota, the producer is not affected or even gains because even if he sells fewer units, he receives a higher price for them. The consumer, on the other hand loses the most because the amount he buys is reduced while the price he pays is increased, thus eating considerably into his consumer surplus (b+d). Since there is no revenue to the government, there is no way of compensating consumers for their loss. The net loss to society is (a+d). From a societal welfare point of view, a tariff is a better tool than a quota.

### **The Effect of Qualitative Restrictions: Non-Tariff Barriers**

Aside from tariffs and quotas, governments have other ways of protecting their home industries (domestic producers). These are any kind of legal, regulatory, product standard or administrative measures, rules or regulations that have the effect of a) raising the price of the product for the exporter, b) lowering the amount that the exporter can sell in the home market or a combination of the two. These restrictions or barriers to trade are collectively called **non-tariff barriers** (NTBs) to trade. While every sovereign country has the right to decide what rules and regulations or standards it wants to set in its home market and much of the time it does so for legitimate reasons, these rules and standards can also be used as an excuse or pretext to keep out unwanted imports and protect domestic producers. The line that separates legitimate and opportunistic reasons is often hard to discern while the list of non-tariff barriers is quite covert and long.

### **Consumer vs. Producer Interest and Private vs. Public Interest**

When one analyzes the costs and benefits of international trade on a country's economy one must recognize that protecting domestic producers is not always in the best interest of a nation. True, tariffs, quotas and non-tariff barriers may help provide protection for domestic producers which are the firms and those working for them, but they also raise the cost of products for all consumers and reduce the consumer surplus that all consumers enjoy, thus lowering buying power and reducing living standards. While the producers are few, the consumer is everyone. Protection for home producers should not be equated as being necessarily in the public interest. Very often, those routing for protection are not the firms that produce the products, but their workers. Unionized labour has a vested interest in preserving jobs and almost always will demand protectionism, even if this works against the best interests of their workers. Why? first because protectionist measures raise the cost of living and reduce the buying power of workers and secondly because protectionism limits the potential for growth in the industry and growth in future jobs. Thus, what is good for a domestic industry, is not necessarily good for the economy at large. In short, protectionism benefits few producers at the expense of all consumers and reduces the incentive for innovation and the potential for future growth. Put differently, domestic producers and their unions claim that protectionism benefits the public interest when in fact it benefits the private interests of the owners of protected industries and their workers at the expense of the public interest. Removing barriers to trade might harm selected private interests but benefit the public at large.

Thus one must be careful to remember that consumer interest does not coincide with producer interest and that the two are not always aligned together. Likewise, private and public interest are not always the same and not always aligned with each other.