Elasticity of Demand

Concepts of elasticity of demand:
From Law of Demand to Elasticity of Demand

Demand function, Q_{dx} = f (Px, Y, Ps, Pc…….); Where, Px = price of the commodity itself; Y = income of the consumers; Ps = Prices of substitutes; Pc = Prices of complementary goods.

So there are THREE basic types of elasticity of demand: Price elasticity, Income elasticity and cross-price elasticity.

Implications of Elasticity of Demand: Why should we study elasticity of demand.

(a) What does the elasticity of demand measure in general? (b) What do the price elasticity of demand, the income elasticity of demand, and the cross elasticity of demand measure in general?

(a) The amount of a commodity purchased per unit of time is a function of or depends on the price of the commodity, money incomes, the prices of other (related) commodities, tastes, and the number of buyers of the commodity in the market. A change in any of the above factors will cause a change in the amount of the commodity purchased per unit of time. **The elasticity of demand measures the relative responsiveness in the amount purchased per unit of time to a change in any one of the above factors, while keeping the others constant.**

(b) **The price elasticity of demand** measures the relative responsiveness in the quantity of a commodity demanded to changes in its price.

The income elasticity of demand measures the relative responsiveness in the amount purchased to changes in money income.

The cross elasticity of demand measures the relative responsiveness in the amount purchased to changes in the price of a related commodity.

The above elasticity concepts apply as much to the individual consumer's response as to the market response. However, we are primarily interested in the market responses.

Measuring Price Elasticity of demand

Price elasticity of demand: The responsiveness of quantity demanded to a change in price. It is the rate at which quantity bought changes as the price changes other things remaining the same.

Since price and quantity are measured in different units, the only sensible way we can do this is to use percentage or proportionate changes. This gives us the following *formula for the price elasticity of demand (Ed) for a product.*

Formula for price elasticity of demand (*Ep):* The percentage (or proportionate) change in quantity demanded divided by the percentage (or proportionate) change in price.

Ep = *percentage* (or proportionate) change in quantity demanded / percentage (or proportionate) change in price.

Say ,	Price	Quantity	So Change in price:
	P	Q	ΔP =P - P1
	P1	Q1	Change in Quantity:
			ΔQ = Q - Q1

Since Ep = Proportionate (or %) change in the amount demanded ÷ Proportionate (or %) change in price.

Ep = change in the amount demanded/Original demand ÷ change in the price /Original price.

Price elasticity, Ep = (ΔQ/ΔP) * (P/Q)

$$\mathbf{Ep} = -\frac{\Delta Q/Q}{\Delta P/P} = -\frac{\Delta Q}{\Delta P}\cdot\frac{P}{Q}$$

The sign (positive or negative): Demand curves are generally downward sloping. This means that price and quantity change in opposite directions. A *rise* in price (a positive figure) will cause a *fall in the quantity* demanded (a negative figure). Similarly a *fall in price will* cause a *rise in the quantity demanded. Thus when working* out price elasticity of demand, we either divide a negative figure by a positive figure, or a positive figure by a negative. Either way, we end up with a negative figure.

Income Elasticity of Demand

Likewise, Income elasticity, Em = $(\Delta Q/\Delta M) * (M/Q)$.

Since Em = Proportionate or % change in the amount demanded/ Proportionate or % change in income.

Measuring Income Elasticity of Demand

The coefficient of income elasticity of demand (Em) measures the percentage change in the amount of a commodity purchased per unit time (ΔQ/Q) resulting from a given percentage change in a consumer's income (ΔM/M). Thus

$$e_M = \frac{\Delta Q/Q}{\Delta M/M} = \frac{\Delta Q}{\Delta M} \cdot \frac{M}{Q}$$

When Em is negative, the good is inferior. If Em is positive, the good is normal. A normal good is usually a luxury if its Em >1, otherwise it is a necessity. Depending on the level of the consumer's income, Em for a good is likely to vary considerably. Thus a good may be a luxury at "low" levels of income, a necessity at "intermediate" levels of income and an inferior good at "high" levels of income.

Measuring Cross-price elasticity of demand

This is often known by its less cumbersome title of cross elasticity of demand. If good X is a substitute for good Y, X's demand will rise as Y's price rises. In this case, cross elasticity will be a positive figure. For example, if the demand for Soybean oil rose by 2 per cent when the price of Palm oil (a substitute) rose by 8 per cent, then the cross elasticity of demand for Soybean oil with respect to Palm oil would be: 2% / 8% = 0.25

If good X is complementary to good Y, however, X's demand will fall as Y's price rises and thus as the quantity of X demanded falls. In this case, cross elasticity of demand will be a negative figure. For example, if a 4 per cent rise in the price of bread led to a 3 per cent fall in demand for butter, the cross elasticity of demand for butter with respect to bread would be: −3%/4% =−0.75.

Cross-price elasticity, $Exz = (\Delta Qx/\Delta Pz) * (Pz/Qx)$.

Since Exz = Proportionate or % change in the amount demanded for X/ Proportionate or % change in the price of Z.

The Range of values of elasticity are $0 \leq Ep \leq \infty$

#The value (greater or less than 1): If we now ignore the negative sign and just concentrate on the value of the figure, this tell us whether demand is *elastic or inelastic. Unit elastic (= 1).*

#Elastic demand Where quantity demanded changes by a greater percentage than price. Ignoring the negative sign, it will have a value more than 1.

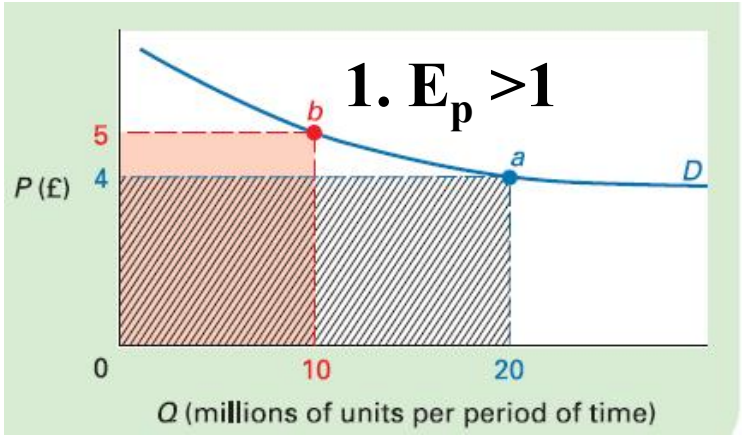
#Inelastic demand Where quantity demanded changes by a smaller percentage than price. Ignoring the negative sign, it will have a value less than 1.

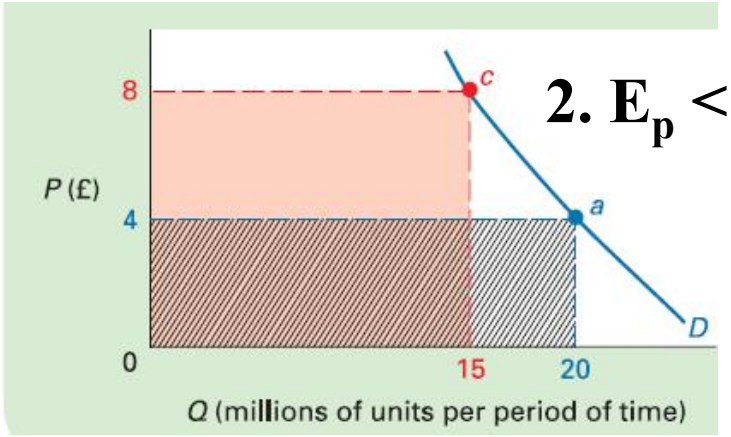
#Unit elasticity of demand Where quantity demanded changes by the same percentage as price. Ignoring the negative sign, it will have a value equal to 1.

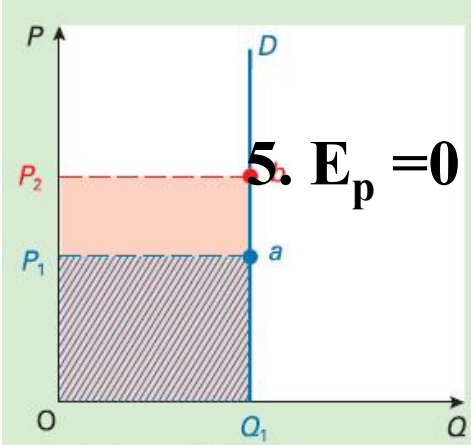
#Perfectly Elastic demand: When demand curve is horizontal, i.e., the price elasticity is perfectly elastic.

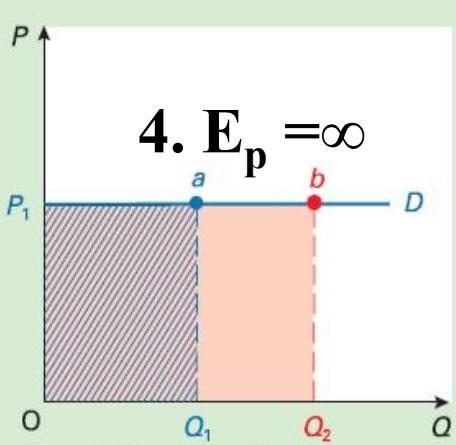
#**Perfectly inelastic demand**: When demand curve is vertical i.e., demand remains the same with the change in price.

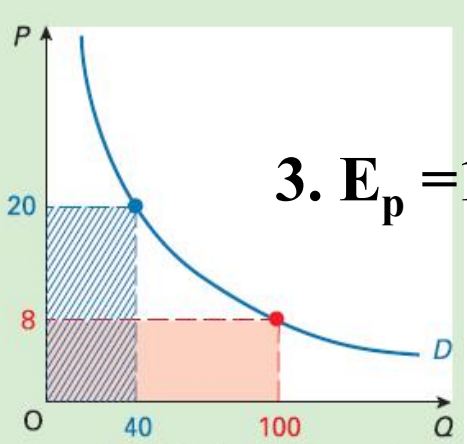
Elastic and Inelastic Demand











PRICE ELASTICITY OF SUPPLY:

The coefficient of price elasticity of supply(es) measures the percentage change in the quantity supplied of a commodity per unit of time (DQ=Q) resulting from a given percentage change in the price of the commodity (DP=P). Thus

$$e_s = \frac{\Delta Q/Q}{\Delta P/P} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

6.20. Given $Q_1 = 100 - P_1 + 0.75P_2 - 0.25P_3 + 0.0075Y$. At $P_1 = 10$, $P_2 = 20$, $P_3 = 40$, and $Y = 10{,}000$, $Q_1 = 170$. Find the different cross price elasticities of demand.

$$\epsilon_{12} = \frac{\partial Q_1}{\partial P_2}\left(\frac{P_2}{Q_1}\right) = 0.75\left(\frac{20}{170}\right) = 0.088$$

$$\epsilon_{13} = \frac{\partial Q_1}{\partial P_3}\left(\frac{P_3}{Q_1}\right) = -0.25\left(\frac{40}{170}\right) = -0.059$$

6.21. Given $Q_1 = 50 - 4P_1 - 3P_2 + 2P_3 + 0.001Y$. At $P_1 = 5$, $P_2 = 7$, $P_3 = 3$, and $Y = 11{,}000$, $Q_1 = 26$. (*a*) Use cross price elasticities to determine the relationship between good 1 and the other two goods. (*b*) Determine the effect on Q_1 of a 10 percent price increase for each of the other goods individually.

a)

$$\epsilon_{12} = -3\left(\tfrac{7}{26}\right) = -0.81 \qquad \epsilon_{13} = 2\left(\tfrac{3}{26}\right) = 0.23$$

With ϵ_{12} negative, goods 1 and 2 are complements. An increase in P_2 will lead to a decrease in Q_1. With ϵ_{13} positive, goods 1 and 3 are substitutes. An increase in P_3 will increase Q_1.

b)

$$\epsilon_{12} = \frac{\partial Q_1}{Q_1} \div \frac{\partial P_2}{P_2}$$

Rearranging terms and substituting the known parameters,

$$\frac{\partial Q_1}{Q_1} = \epsilon_{12}\frac{\partial P_2}{P_2} = -0.81(0.10) = -0.081$$

If P_2 increases by 10 percent, Q_1 decreases by 8.1 percent.

$$\epsilon_{13} = \frac{\partial Q_1}{Q_1} \div \frac{\partial P_3}{P_3}$$

$$\frac{\partial Q_1}{Q_1} = \epsilon_{13}\frac{\partial P_3}{P_3} = 0.23(0.10) = 0.023$$

If P_3 increases by 10 percent, Q_1 increases by 2.3 percent.

What factors govern the size of the coefficient of price elasticity of demand?

1.Number and closeness of substitutes for the commodity: The more and better the available substitutes for a commodity, the greater its price elasticity of demand is likely to be. Thus, when the price of tea rises, consumers readily switch to good substitutes such as coffee and cocoa, so the coefficient of price elasticity of demand for tea is likely to be high. On the other hand, since there are no good substitutes for salt, its elasticity is likely to be very low.

2. Number of uses of the commodity: The greater the number of uses of a commodity, the greater is its price elasticity. For example, the elasticity of aluminum is likely to be much greater than that of butter since butter can be used only as food while aluminum has hundreds of uses (e.g., aircraft, electrical wiring, appliances, and so on).

3. Expenditures on the commodity: The greater the percentage of income spent on a commodity, the greater its elasticity is likely to be. Thus the demand for cars is likely to be much more price-elastic than that for shoes.

4. Adjustment time: The longer the period allowed for adjustment in the quantity of a commodity demanded, the more elastic its demand is likely to be. This is so because it takes time for consumers to learn of new prices and new products. In addition, even after a decision is made to switch to other products, some time may pass before the switch is actually made.

5. Level of price: If the ruling price is toward the upper end of the demand curve, demand is likely to be more elastic than if it were toward the lower end. This is always true for a negatively sloped straight-line demand curve and is usually true for curvilinear demand curves.

Engel's Law

Ernst Engel, a German statistician, proposed this law in the nineteenth century. ***Main theme of the Law:*** **The percentage of income spent on food decreases as incomes increases, i.e., the income elasticity of demand for food is less than unity and greater than zero ($0<E_m<1$).** To conclude this expenditure pattern, Engel studied the consumption patterns of a large number of households. Later, many other researchers has been confirmed his findings repeatedly.

Implication of Engel's Law: During the period of economic prosperity, farmers may not prosper as much as people in other occupations. The reason is that if expenditures on food do not keep pace with increase in gross domestic product, farm incomes may not increase as rapidly as incomes in general. *However, this tendency has partially offset by the rapid increase in farm productivity in the recent years.*

Economic theory that the proportion of income spent on food decreases as income increases, other factors remaining constant. This law does not suggest that money spent on food falls with increase in income, but instead that the percentage of income spent on food rises slower than the percentage increase in income. Proposed by the German statistician Ernst Engel (1821-96) in his 1857 paper. Not to be confused with Friedrich Engels, Karl Marx's associate (see communism). **Google**

Read more:
http://www.businessdictionary.com/definition/Engel-s-Law.html

Why don't we use the slope of the demand curve (i.e.,ΔP/ ΔQ) or its reciprocal (i.e., ΔQ/ ΔP) to measure the responsiveness in the quantity of a commodity demanded to a change in its price?

The slope is not a useful measure since it is expressed in terms of the units of the problem. Thus by simply changing the units of the problem we can get a different slope. The use of the slope also would not allow us to compare in a meaningful way the degree of responsiveness of different commodities to changes in their prices. The coefficient of price elasticity of demand, relating as it does the percentage change in quantity to the corresponding percentage change in price, gives a measure which is independent of the units of the problem (i.e.,e is a pure number).

Why is it that when two commodities are substitutes for each other, the cross elasticity of demand between them is positive while when they are complements it is negative? (b) How can we define an industry by using cross elasticities? What difficulties does this lead to?

(a) For two commodities which are substitutes, a change in the price of one, ceteris paribus, causes a change in the same direction in the quantity purchased of the other. For example, an increase in the price of coffee increases tea consumption and a decrease in the price of coffee decreases tea consumption. Thus the cross elasticity between them is positive. On the other hand, ceteris paribus, a change in the price of a commodity causes the quantity purchased of its complement to move in the opposite direction. Thus the cross elasticity between them will be negative. It should be noted that commodities may be substitutes over some range of prices and complements over others.

b) High positive cross elasticities (indicating a high degree of substitutability) among a group of commodities can be (and frequently is) used to define the boundaries of an industry.

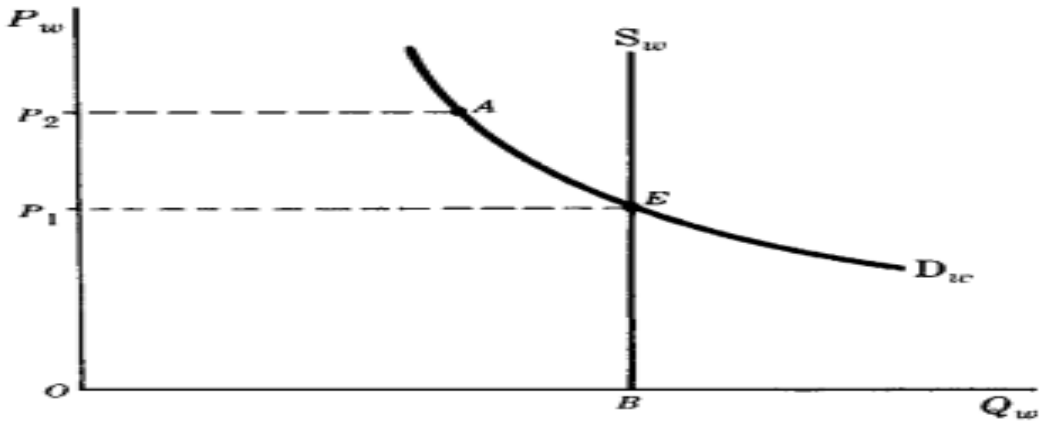
This, however, may sometimes lead to difficulties. For example, how high should cross elasticities be among a group of commodities in order for us to include them in the same industry? In addition, if the cross elasticity of demand between cars and station wagons and between station wagons and small trucks is positive and very high but the cross elasticity between cars and small trucks is positive but low, are cars and small trucks in the same industry? In these and other cases, the definition of the industry adopted usually depends on the problem to be studied.

If the market demand for agricultural commodities is price-inelastic, would a bad harvest lead to an increase or a decrease in the incomes of farmers as a group? Why?

A bad harvest is reflected in a decrease in supply (i.e., an upward shift in the market supply curve of agricultural commodities). Given the market demand for agricultural commodities, this decrease in supply causes the equilibrium price to rise. Since the demand is price-inelastic, the total receipts of farmers as a group increase. When the demand for an agricultural commodity is price-inelastic, the same result can be achieved by reducing the amount of land under cultivation for the commodity. This is done in some farm-aid programs.

With reference to the following figure, consider the following two farm-aid programs for wheat farmers. **I.** The government sets the price of wheat at P2 and purchases the resulting surplus of wheat at P2.

II. The government allows wheat to be sold at the equilibrium price of P1and grants each farmer a cash subsidy of P2-P1 on each unit sold. Which of the two programs is more expensive to the government?



Under both programs, the total receipts of wheat farmers as a group are the same (OP2 times OB).The greater the fraction of this total paid by the consumers of wheat, the smaller the cost to the government. If Dw is elastic at every point of arc AE, consumers' expenditures on wheat would be greater under the second program, and so the second program would cost less to the government. If Dw is inelastic at every point of arc AE, consumers' expenditures on wheat would be greater under the first program, and so the first program would cost less to the government. If Dw has unitary elasticity at every point of arc AE, both programs would cost the same to the government.

The way the above figure is drawn, the first program would cost less to the government. (We assumed no storage costs. We have also not considered what the government does with the surplus wheat and what is the effect of each of the two programs on the welfare of consumers.)