Price elasticity of demand

Price elasticity of demand (PED or Ed) is a measure used in economics to show the responsiveness , or elasticity , of the quantity demanded of a good or service to a change in its price , ceteris paribus . More precisely , it gives the percentage change in quantity demanded in response to a one percent change in price (ceteris paribus)

Price elasticities are almost always negative , although analysts tend to ignore the sign even though this can lead to ambiguity . Only goods which do not conform to the law of demand , such as Veblen and Giffen goods , have a positive PED . In general , the demand for a good is said to be inelastic (or relatively inelastic) when the PED is less than one (in absolute value) : that is , changes in price have a relatively small effect on the quantity of the good demanded . The demand for a good is said to be elastic (or relatively elastic) when its PED is greater than one (in absolute value) : that is , changes in price have a relatively large effect on the quantity of a good demanded .

Revenue is maximized when price is set so that the PED is exactly one . The PED of a good can also be used to predict the incidence (or " burden ") of a tax on that good . Various research methods are used to determine price elasticity , including test markets , analysis of historical sales data and conjoint analysis .

Definition

It is a measure of responsiveness of the quantity of a raw good or service demanded to changes in its price . The formula for the coefficient of price elasticity of demand for a good is :

<formula>

The above formula usually yields a negative value , due to the inverse nature of the relationship between price and quantity demanded , as described by the " law of demand " . For example , if the price increases by 5 % and quantity demanded decreases by 5 % , then the elasticity at the initial price and quantity

= ? 5 % / 5 % =

? 1 . The only classes of goods which have a PED of greater than 0 are Veblen and Giffen goods . Although the PED is negative for the vast majority of goods and services , economists often refer to price elasticity of demand as a positive value (i.e. , in absolute value terms) .

This measure of elasticity is sometimes referred to as the own @-@ price elasticity of demand for a good , i.e. , the elasticity of demand with respect to the good 's own price , in order to distinguish it from the elasticity of demand for that good with respect to the change in the price of some other good , i.e. , a complementary or substitute good . The latter type of elasticity measure is called a cross @-@ price elasticity of demand .

As the difference between the two prices or quantities increases , the accuracy of the PED given by the formula above decreases for a combination of two reasons . First , the PED for a good is not necessarily constant ; as explained below , PED can vary at different points along the demand curve , due to its percentage nature . Elasticity is not the same thing as the slope of the demand curve , which is dependent on the units used for both price and quantity . Second , percentage changes are not symmetric ; instead , the percentage change between any two values depends on which one is chosen as the starting value and which as the ending value . For example , if quantity demanded increases from 10 units to 15 units , the percentage change is 50 % , i.e. , (15 ? 10) ÷ 10 (converted to a percentage) . But if quantity demanded decreases from 15 units to 10 units , the percentage change is ? 33 @.@ 3 % , i.e. , (10 ? 15) ÷ 15 .

Two alternative elasticity measures avoid or minimise these shortcomings of the basic elasticity formula : point @-@ price elasticity and arc elasticity .

Point @-@ price elasticity of demand

Point elasticity of demand method is used to determine change in demand within same demand curve , basically a very small amount of change in demand is measured through point elasticity . (

Maharjan , R.) One way to avoid the accuracy problem described above is to minimise the difference between the starting and ending prices and quantities . This is the approach taken in the definition of point @-@ price elasticity , which uses differential calculus to calculate the elasticity for an infinitesimal change in price and quantity at any given point on the demand curve :
<formula>
In other words , it is equal to the absolute value of the first derivative of quantity with respect to price (dQd / dP) multiplied by the point 's price (P) divided by its quantity (Qd) .
In terms of partial @-@ differential calculus , point @-@ price elasticity of demand can be defined as follows : let <formula> be the demand of goods <formula> as a function of parameters price and wealth , and let <formula> be the demand for good <formula> . The elasticity of demand for good <formula> with respect to price <formula> is
<formula>
However , the point @-@ price elasticity can be computed only if the formula for the demand function , <formula> , is known so its derivative with respect to price , <formula> , can be determined .

= = = Arc elasticity = = =

A second solution to the asymmetry problem of having a PED dependent on which of the two given points on a demand curve is chosen as the " original " point and which as the " new " one is to compute the percentage change in P and Q relative to the average of the two prices and the average of the two quantities , rather than just the change relative to one point or the other . Loosely speaking , this gives an " average " elasticity for the section of the actual demand curve ? i.e. , the arc of the curve ? between the two points . As a result , this measure is known as the arc elasticity , in this case with respect to the price of the good . The arc elasticity is defined mathematically as :
<formula>
This method for computing the price elasticity is also known as the " midpoints formula " , because the average price and average quantity are the coordinates of the midpoint of the straight line between the two given points . This formula is an application of the midpoint method . However , because this formula implicitly assumes the section of the demand curve between those points is linear , the greater the curvature of the actual demand curve is over that range , the worse this approximation of its elasticity will be .

= = History = =

Together with the concept of an economic " elasticity " coefficient , Alfred Marshall is credited with defining PED (" elasticity of demand ") in his book Principles of Economics , published in 1890 . He described it thus : " And we may say generally : ? the elasticity (or responsiveness) of demand in a market is great or small according as the amount demanded increases much or little for a given fall in price , and diminishes much or little for a given rise in price " . He reasons this since " the only universal law as to a person 's desire for a commodity is that it diminishes ... but this diminution may be slow or rapid . If it is slow ... a small fall in price will cause a comparatively large increase in his purchases . But if it is rapid , a small fall in price will cause only a very small increase in his purchases . In the former case ... the elasticity of his wants , we may say , is great . In the latter case ... the elasticity of his demand is small . " Mathematically , the Marshallian PED was based on a point @-@ price definition , using differential calculus to calculate elasticities .

= = Determinants = =

The overriding factor in determining PED is the willingness and ability of consumers after a price change to postpone immediate consumption decisions concerning the good and to search for substitutes (" wait and look ") . A number of factors can thus affect the elasticity of demand for a good :

Availability of substitute goods

The more and closer the substitutes available , the higher the elasticity is likely to be , as people can easily switch from one good to another if an even minor price change is made ; There is a strong substitution effect . If no close substitutes are available , the substitution effect will be small and the demand inelastic .

Breadth of definition of a good

The broader the definition of a good (or service) , the lower the elasticity . For example , Company X 's fish and chips would tend to have a relatively high elasticity of demand if a significant number of substitutes are available , whereas food in general would have an extremely low elasticity of demand because no substitutes exist .

Percentage of income

The higher the percentage of the consumer 's income that the product 's price represents , the higher the elasticity tends to be , as people will pay more attention when purchasing the good because of its cost ; The income effect is substantial . When the goods represent only a negligible portion of the budget the income effect will be insignificant and demand inelastic ,

Necessity

The more necessary a good is , the lower the elasticity , as people will attempt to buy it no matter the price , such as the case of insulin for those who need it .

Duration

For most goods , the longer a price change holds , the higher the elasticity is likely to be , as more and more consumers find they have the time and inclination to search for substitutes . When fuel prices increase suddenly , for instance , consumers may still fill up their empty tanks in the short run , but when prices remain high over several years , more consumers will reduce their demand for fuel by switching to carpooling or public transportation , investing in vehicles with greater fuel economy or taking other measures . This does not hold for consumer durables such as the cars themselves , however ; eventually , it may become necessary for consumers to replace their present cars , so one would expect demand to be less elastic .

Brand loyalty

An attachment to a certain brand ? either out of tradition or because of proprietary barriers ? can override sensitivity to price changes , resulting in more inelastic demand .

Who pays

Where the purchaser does not directly pay for the good they consume , such as with corporate expense accounts , demand is likely to be more inelastic .

= = Interpreting values of price elasticity coefficients = =

Elasticities of demand are interpreted as follows :

A decrease in the price of a good normally results in an increase in the quantity demanded by consumers because of the law of demand , and conversely , quantity demanded decreases when price rises . As summarized in the table above , the PED for a good or service is referred to by different descriptive terms depending on whether the elasticity coefficient is greater than , equal to , or less than ? 1 . That is , the demand for a good is called :

relatively inelastic when the percentage change in quantity demanded is less than the percentage change in price (so that $E_d > -1$) ;

unit elastic , unit elasticity , unitary elasticity , or unitarily elastic demand when the percentage change in quantity demanded is equal to the percentage change in price (so that $E_d = -1$) ; and

relatively elastic when the percentage change in quantity demanded is greater than the percentage change in price (so that $E_d < -1$) .

As the two accompanying diagrams show , perfectly elastic demand is represented graphically as a horizontal line , and perfectly inelastic demand as a vertical line . These are the only cases in which the PED and the slope of the demand curve (? P / ? Q) are both constant , as well as the only cases in which the PED is determined solely by the slope of the demand curve (or more precisely , by the inverse of that slope) .

= = Relation to marginal revenue = =

The following equation holds :
<formula>
where
R ' is the marginal revenue
P is the price
Proof :
TR = Total Revenue <formula> <formula> <formula>
On a graph with both a demand curve and a marginal revenue curve , demand will be elastic at all quantities where marginal revenue is positive . Demand is unit elastic at the quantity where marginal revenue is zero . Demand is inelastic at every quantity where marginal revenue is negative .

= = Effect on total revenue = =

A firm considering a price change must know what effect the change in price will have on total revenue . Revenue is simply the product of unit price times quantity :
<formula>
Generally any change in price will have two effects :
The price effect
For inelastic goods , an increase in unit price will tend to increase revenue , while a decrease in price will tend to decrease revenue . (The effect is reversed for elastic goods .)
The quantity effect
An increase in unit price will tend to lead to fewer units sold , while a decrease in unit price will tend to lead to more units sold .
For inelastic goods , because of the inverse nature of the relationship between price and quantity demanded (i.e. , the law of demand) , the two effects affect total revenue in opposite directions . But in determining whether to increase or decrease prices , a firm needs to know what the net effect will be . Elasticity provides the answer : The percentage change in total revenue is approximately equal to the percentage change in quantity demanded plus the percentage change in price . (One change will be positive , the other negative .) The percentage change in quantity is related to the percentage change in price by elasticity : hence the percentage change in revenue can be calculated by knowing the elasticity and the percentage change in price alone .
As a result , the relationship between PED and total revenue can be described for any good :