

Subject: Microeconomic Theory I

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PRICE ELASTICITY OF DEMAND

Measurement and Interpretation of Price Elasticity of Demand

The price elasticity of demand (PED) for a good is a measure of the degree of responsiveness of the quantity demanded to a change in the price, *ceteris paribus*.

The PED for a good is calculated by dividing the percentage change in the quantity demanded by the percentage change in the price.

$$\text{PED} = \frac{\% \Delta \text{Quantity Demanded}}{\% \Delta \text{Price}}$$

Due to the law of demand, the PED for a good is always negative. However, the common practice among economists is to omit the negative sign.

If the PED for a good is greater than one, the demand is price elastic which means that a change in the price will lead to a larger percentage/proportionate change in the quantity demanded. A good with a price elastic demand has a relatively flat demand curve. If the PED for a good is less than one, the demand is price inelastic which means that a change in the price will lead to a smaller percentage/proportionate change in the quantity demanded. A good with a price inelastic demand has a relatively steep demand curve. If the PED for a good is equal to one, the demand is unit price elastic which means that a change in the price will lead to the same percentage/proportionate change in the quantity demanded. The demand curve for a good with a unit price elastic demand is a rectangular hyperbola.

Special cases:

If the PED for a good is zero, the demand is perfectly price inelastic which means that a change in the price will not lead to any change in the quantity demanded. A good with a perfectly price inelastic demand has a vertical demand curve. If the PED for a good is

infinity, the demand is perfectly price elastic which means that a rise in the price will lead to an infinite decrease in the quantity demanded. In theory, this means that the quantity demanded will fall from infinity to zero. A good with a perfectly price elastic demand has a horizontal demand curve.

Applications of Price Elasticity of Demand

The concept of PED allows a firm to determine how to change price to increase total revenue.

If the demand for the good produced by a firm is price elastic, the firm can decrease the price to increase the total revenue as the quantity demanded will increase by a larger percentage.

In the above diagram, the initial total revenue is area A plus area B and the new total revenue is area B plus area C. Area C is the gain in revenue resulting from the increase in the quantity demanded (Q) from Q_0 to Q_1 and area A is the loss in revenue resulting from the fall in the price (P) from P_0 to P_1 . Since area C is greater than area A, the gain in revenue exceeds the loss and hence the total revenue rises.

If the demand for the good produced by a firm is price inelastic, the firm can increase the price to increase the total revenue as the quantity demanded will decrease by a smaller percentage.

In the above diagram, the initial total revenue is area B plus area C and the new total revenue is area A plus area B. Area A is the gain in revenue resulting from the rise in the price (P) from P_0 to P_1 and area C is the loss in revenue resulting from the decrease in the quantity demanded (Q) from Q_0 to Q_1 . Since area A is greater than area C, the gain in revenue exceeds the loss and hence the total revenue rises.

If the demand for the good produced by a firm is unit price elastic, the firm cannot change the price to increase the total revenue as the quantity demanded will change by the same percentage.

In addition to firms, the concept of price elasticity of demand may be useful to the government. The main source of revenue for the government is tax revenue. If the government imposes a tax on a good, the cost of production will rise which will lead to a decrease in the supply. When this happens, the price will rise which will lead to a fall in the quantity demanded. If the demand for the good is price elastic, the quantity demanded is likely to fall by a large extent. As the tax revenue is the product of the tax per unit of the good and the quantity, a large decrease in the quantity demanded is likely to limit the amount of tax revenue which the government is able to collect. Therefore, if the government wants to collect a large amount of tax revenue from imposing a tax on a good, it should do so for a good with a price inelastic demand. Examples of goods with a price inelastic demand include tobacco and alcohol due to their addictive nature. The government

may also impose a tax on a good to reduce the consumption. This is generally a good which society deems undesirable and the government thinks people should be discouraged from consuming, commonly known as a demerit good. Examples of demerit goods include tobacco and alcohol. However, due to the addictive nature of tobacco and alcohol which makes the demand price inelastic, a tax on these goods is likely to lead to a small decrease in the quantity demanded. Therefore, for a tax on tobacco and alcohol to be effective for reducing the consumption, the government should ensure that it is sufficiently high.

Determinants of Price Elasticity of Demand

Number of Substitutes

The PED for a good will be higher the larger the number of substitutes. Conversely, the PED for a good will be lower the smaller the number of substitutes. For example, the demand for a brand of smartphones is likely to be price elastic due to the large number of substitute brands in the market such as Apple, Samsung, LG, HTC, Sony, BlackBerry, etc. The number of substitutes for a good depends, in part, on how narrowly, and for that matter, how broadly the good is defined. The more broadly a good is defined, the smaller the number of substitutes and hence the less price elastic the demand for the good. Conversely, the more narrowly a good is defined, the larger the number of substitutes and hence the more price elastic the demand for the good. For example, the demand for beef is more price elastic than the demand for food because, unlike food, there are substitutes for beef.

Closeness of Substitutes

The PED for a good will be higher the closer the substitutes. Conversely, the PED for a good will be lower the further the substitutes. For example, the demand for residential properties is price inelastic due to lack of close substitutes, apart from the high degree of necessity. In contrast, the demand for the mobile network services provided by an operator in Singapore such as SingTel is likely to be price elastic due to the presence of close substitutes which include the mobile network services provided by other operators such as M1 and StarHub.

Degree of Necessity

The PED for a good will be higher the lower the degree of necessity. Conversely, the PED for a good will be lower the higher the degree of necessity. For example, the demand for oil is price inelastic due to the high degree of necessity, apart from lack of close substitutes.

Proportion of Income Spent on the Good

The PED for a good will be higher the larger the proportion of income spent on the good. Conversely, the PED for a good will be lower the smaller the proportion of income spent on the good. For example, the demand for private cars is likely to be price elastic due to the large proportion of income spent on the goods as they are generally expensive. In

contrast, the demand for stationery is likely to be price inelastic due to the small proportion of income spent on the good as it is generally cheap, apart from the high degree of necessity.

Time Period

The PED for a good will be higher the longer the time period under consideration. Conversely, the PED for a good will be lower the shorter the time period under consideration. This is because consumers need time to adjust their consumption patterns and find substitutes. For example, given any increase in the price of petrol, the quantity demanded will not fall significantly in the short run as people need to drive their cars. However, the quantity demanded will fall more significantly over time as more fuel-efficient cars can be developed and people can switch to smaller cars which consume less fuel.

INCOME ELASTICITY OF DEMAND

Measurement and Interpretation of Income Elasticity of Demand

The income elasticity of demand (YED) for a good is a measure of the degree of responsiveness of the demand to a change in income, *ceteris paribus*.

The YED for a good is calculated by dividing the percentage change in the demand by the percentage change in income.

$$\text{YED} = \frac{\% \Delta \text{Demand}}{\% \Delta \text{Income}}$$

If the YED for a good is positive, the good is a normal good. A normal good is a good whose demand rises when consumers' income rises. There are two types of normal goods: necessity and luxury. A necessity is a normal good with a YED between zero and one. In other words, the demand for a necessity is income inelastic. An example of a necessity is agricultural products. A luxury is a normal good with a YED greater than one. In other words, the demand for a luxury is income elastic. An example of a luxury is private cars. If the YED for a good is negative, the good is an inferior good. An inferior good is a good whose demand falls when consumers' income rises. An example of an inferior good is public transport.

Applications of Income Elasticity of Demand

The concept of YED allows a firm to determine the future size of the market for the good and hence its production capacity. Suppose that the YED for a good is positive. If a firm predicts an economic expansion which is a period of time during which national income is

rising, it should increase its production capacity in order to be able to meet the higher demand when the economic expansion comes. Furthermore, the higher the YED is, the larger will be the increase in the demand and hence the larger the extent the firm should increase its production capacity. Conversely, if the firm predicts an economic contraction which is a period of time during which national income is falling, it should decrease its production capacity to minimise excess capacity when the economic contraction comes.

The concept of YED may enable a firm to determine how to formulate its marketing strategy. Suppose that a firm sells two goods. Further suppose that one of the goods is a normal good and the other good is an inferior good. If the economy is expanding and hence national income is rising, the firm should focus its marketing strategy on the normal good. Conversely, if the economy is contracting and hence national income is falling, the firm should focus its marketing strategy on the inferior good.

Determinants of Income Elasticity of Demand

Degree of Luxury

The YED for a good will be higher the more luxurious the good. Conversely, the YED for a good will be lower the less luxurious the good. For example, the YED for high-end private cars is higher than those for mid-range and low-end private cars as high-end private cars are more luxurious than mid-range and low-end private cars.

Level of Income

The YED for a good will be higher the lower the level of income. Conversely, the YED for a good will be lower the higher the level of income. For example, the YED for private cars in the Philippines is higher than that in Singapore as the level of income in the Philippines is lower than that in Singapore.

CROSS ELASTICITY OF DEMAND

Measurement and Interpretation of Cross Elasticity of Demand

The cross elasticity of demand (XED) for a good with respect to another good is a measure of the degree of responsiveness of the demand for the first good to a change in the price of the second good, *ceteris paribus*. Let the two goods be good A and good B.

The XED for good A with respect to good B is calculated by dividing the percentage change in the demand for good A by the percentage change in the price of good B.

$$XED_{AB} = \frac{\% \Delta \text{ Demand for Good A}}{\% \Delta \text{ Price of Good B}}$$

If XED_{AB} is positive, good A and good B are substitutes. Substitutes are goods which are consumed in place of one another such as Coke and Pepsi. If the price of good B rises, consumers will buy less of it. Since good A and good B are substitutes, they will buy more good A. If XED_{AB} is negative, good A and good B are complements. Complements are goods which are consumed in conjunction with one another such as car and petrol. If the price of good B rises, consumers will buy less of it. Since good A and good B are complements, they will buy less good A.

Applications of Cross Elasticity of Demand

The concept of XED allows a firm to determine how a change in the price of a related good produced by another firm will affect the demand for its good. For example, if a rival firm decreases its price, the demand for the good produced by the first firm will fall due to the positive XED between substitutes. To avoid a decrease in sales, the firm may need to decrease its price. However, if this is likely to lead to a price war, the firm may consider engaging in non-price competition such as product promotion and product development instead of decreasing its price. If a rival firm increases its price, the demand for the good produced by the first firm will increase if it keeps its price constant. However, the firm may not experience an increase in sales if it has no or little excess capacity.

The concept of XED may enable a firm that produces two or more goods which are complements to increase total revenue. For example, a telecommunications firm may reduce the price of its mobile devices even if the demand is price inelastic. Although the revenue from the sale of its mobile devices will fall as the quantity demanded will rise by a smaller proportion, the demand and hence the revenue from the provision of its mobile network services will rise due to the negative XED between mobile network services and mobile devices. Therefore, the total revenue of the telecommunications firm may increase.

Determinants of Cross Elasticity of Demand

The XED between two goods will be higher the more closely they are related. For example, the XED between Coke and Pepsi is higher than that between coffee and tea as Coke and Pepsi are closer substitutes than coffee and tea are.

Books

1. Chapter 3 from Pindyck and Rubinfeld with Mehta (2005), Microeconomics- latest available Edition in market.
2. Chapter 4 from D.N Dwivedi (2016), Microeconomics Theory and Application-- latest available Edition in market.

