



AS – ECONOMICS (9708)

MICRO

CHAPTER 3

Elasticities

Topics

1. Price Elasticity of Demand (PED)
2. Income Elasticity of Demand (YED)
3. Cross Elasticity of Demand (XED)
4. Price Elasticity of Supply (PES)

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Atrey Phorn



TOPIC 1: PRICE ELASTICITY OF DEMAND (PED)

Definition: Elasticity refers to degree of responsiveness of one variable to the change in another variable. In this chapter, we will look at the following elasticities:

1. Price elasticity of Demand
2. Income elasticity of Demand
3. Cross Elasticity of Demand
4. Price Elasticity of Supply

Definition | Price Elasticity of Demand: PED is defined as the degree of responsiveness of Quantity Demanded due to the change in price of a product.

$$\text{PED} = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}} = \frac{\frac{Q_{d2} - Q_{d1}}{Q_{d1}}}{\frac{P_2 - P_1}{P_1}} = \frac{Q_{d2} - Q_{d1}}{P_2 - P_1} \times \frac{P_1}{Q_{d1}}$$

Example: Suppose consumers buy 5000 DVD players when the price is \$300 per unit, and they buy 6000 DVD players when the price is \$255.

Answer:

$$P_1 = \$300 \quad P_2 = \$255$$

$$Q_1 = 5000 \quad Q_2 = 6000$$

$$\text{PED} = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}} = \frac{\frac{Q_{d2} - Q_{d1}}{Q_{d1}}}{\frac{P_2 - P_1}{P_1}}$$

$$\text{PED} = \frac{\frac{6000 - 5000}{5000}}{\frac{255 - 300}{300}} = \frac{\frac{1000}{5000}}{\frac{-45}{300}} = \frac{0.20}{-0.15} = -1.33 \text{ or } 1.33$$

Note: We ignore the negative sign because the demand curve is downward sloping hence the answer will always be -ve.

-ve as price and Qd have a -ve relationship

Uses of PED

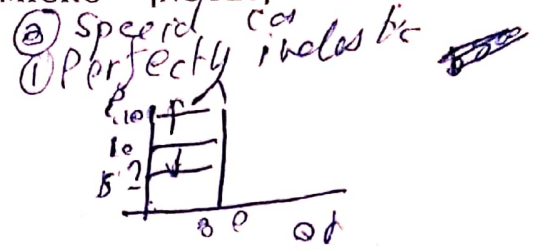
essay

Use	Description
1. Pricing Strategies	This can help the company decide whether to increase the price or decrease it to maximize total revenue. If the price is inelastic the firm should increase the price to maximize total revenue and if the price is elastic, then they should decrease the price to maximize total revenue. (Explained later with a diagram)
2. Price Discrimination	Different sets of customers have different price elasticities of demand. These allow the firm to charge a higher price to those customers who are price inelastic and a lower price to customers who are price elastic. Example: Airlines charge higher prices if you buy the ticket just before a week and charge lower price if you book earlier.
3. Taxation Policies	Govt. can charge higher taxes on demerit goods like cigarettes and alcohol and earn substantial revenue since the demand would not go down even if prices increase.

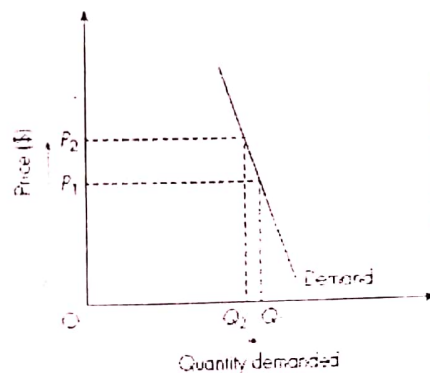
elasticity is always checked from the number as if greater than 1, then elastic, if less than 1

Interpreting PED calculation

1. Price Inelastic
2. Price Elastic
3. Perfectly Inelastic
4. Perfectly Elastic
5. Unitary Elastic

**1. Price Inelastic Demand | $PED < 1$**

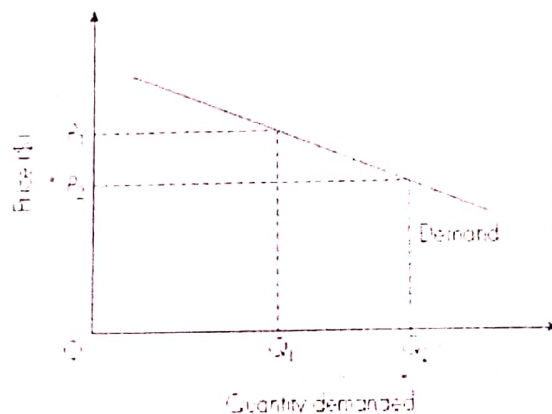
Definition: If the price change causes a smaller proportionate change in quantity demanded the demand is said to be price inelastic. Example: Price went up by 10% however demand decreased by only 5%. In other words if $PED < 1 = \text{Inelastic}$



As the price rises from P_1 to P_2 , the quantity demanded falls by a smaller proportion from Q_1 to Q_2 . Examples of products with low PED are salt, alcohol, electricity, cigarettes and nail clippers

2. Elastic Demand | $PED > 1$

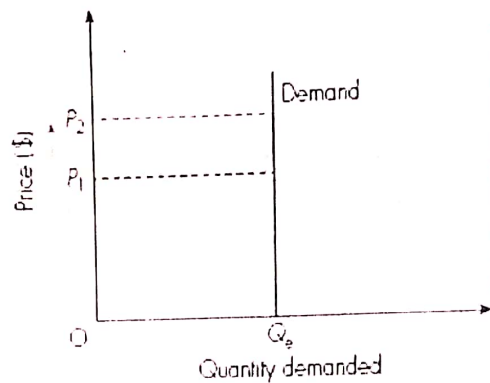
Definition: If the price change causes a greater proportionate change in quantity demanded the demand is said to be price elastic. Example: Price went up by 10% however the demand decreased by 15%. In other words, $PED > 1 = \text{Elastic}$



As the price drops from P_1 to P_2 , the quantity demanded rises by a greater proportion from Q_1 to Q_2 . Examples of products with high PED are chocolate bars, soft drinks, cars and airline travel

3. Perfectly Inelastic | $PED = 0$

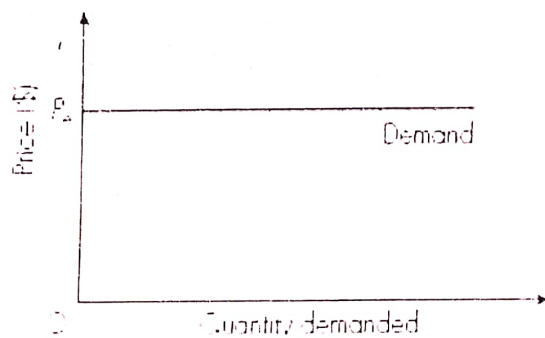
Definition: This is a theoretical possibility where a change in price has no impact on the quantity demanded. Example: Price went up by 20% however the demand stayed the same. In other words, $PED = 0$ = Perfectly Inelastic. These are usually for products that have no substitutes, a real-life example can be a specific lifesaving drug.



As the price increases from P_1 to P_2 , the quantity demanded remains unchanged at Q_0 . Realistically, demand will never be completely independent of the price level, but the demand for prescription drugs, anti-venom or water would be very price inelastic.

4. Perfectly Elastic | $PED = \text{infinity } (\infty)$

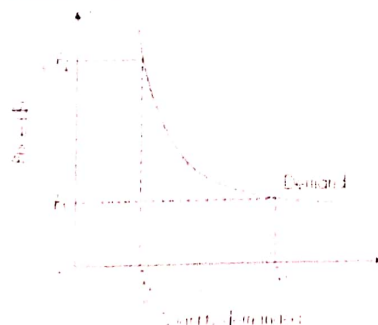
Definition: This is a theoretical possibility where the demand is only on a certain price. If the price increase from that point it will lead to zero quantity demanded. Example: Price went up by 10%, the quantity demanded dropped to zero. In other words, $PED = \text{infinity } (\infty)$. These are usually for products that have perfect substitutes. Example: Petrol. If shell increases its price even by \$1, all the customers will start buying from Total or PSO.



Demand only exists at a price of P_0 . A rise in price above P_0 leads to an infinite change in the quantity demanded. This situation will only exist if there are perfect substitutes readily available on the market.

5. Unitary Elastic | $PED = 1$

Definition: This is a theoretical possibility where the percentage change in price leads to the same proportionate change in quantity demanded. Example: Price increased by 10% and quantity demanded fell by 10%. In other words, $PED = 1$.



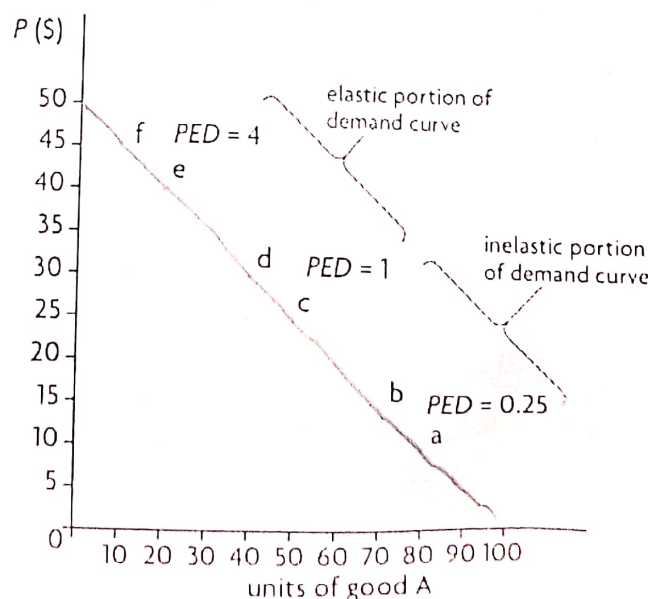
As the price increases from P_1 to P_2 , the quantity demanded falls by the same proportion from Q_1 to Q_2 .

Determinants of Price Elasticity of Demand

Factors	Description
1. Number of Substitutes	1. More the substitutes of a product, it would be easier for consumers to shift from one product to another, hence making the demand more elastic. Example: Mobile phones have several competing brands with similar features. If price of one goes up consumers can easily substitute. However, on the other hand electricity is only available from LESCO making its demand more inelastic.
2. Proportion of consumer Income	Goods like matchboxes are goods in which consumers spend a small amount of their income. Therefore, consumers remain indifferent to any change in price. But goods like car, TV, house etc. are those on which consumer's major income is spent making them inelastic.
3. Nature of the good	Goods and services that are necessities like food, water, clothing have inelastic demand while goods that are luxuries like Nike shoes, Apple watch have elastic demand.
4. Habits, additions, fashion and tastes	Good and services that are addictive in nature e.g. Alcohol, cigarettes, will have inelastic demand since once consumers start they would be unable to stop the use. Similarly, brands that advertise extensively and build a loyal customer base like Beats, Starbucks coffee etc. will have an inelastic demand.
5. Time (Short-run vs Long-run)	In the short run the demand would be inelastic since customer won't be able to adjust their demand, however over the long run they can by searching for substitutes hence making the demand elastic.
6. Definition of a good	If goods and services are broadly defined such as car, house, education, food etc. the demand would be more inelastic, however if a specific type is picked e.g. soft drinks they would be more elastic.

1. Variable PED and the straight-line demand curve

Along any downward-sloping, straight-line demand curve, the PED varies (changes) as we move along the curve.



On any downward-sloping, straight-line demand curve:

1. Demand is price-elastic at high prices and low quantities: This is because when the price is relatively high, a \$1 change in price is a small percentage change which generates a relatively larger percentage change in Qd.

2. At the midpoint of the demand curve, there is unit elastic demand: This is because when the price is in the middle, a \$1 change in price generates an equal percentage change in Qd.

3. Price-inelastic at low price and large quantities: This is because when the price is relatively low, a \$1 change in price is a large percentage change which generates a relatively smaller percentage change in Qd.

Important points of a straight-line demand curve:

1. The terms 'elastic' and 'inelastic' should not be used to refer to an entire demand curve (with the exception of the three special cases (Perfectly elastic, Perfectly inelastic and unitary elastic where PED is constant throughout the entire demand curve). Instead, they should be used to refer to a portion of the demand curve that corresponds to a particular price or price range.

2. PED should not be confused with the slope of a demand curve. Whereas the slope is constant for a linear (straight-line) demand curve, PED varies throughout its range. It is not only the steepness of the demand curve that determines elasticity but also the point on the curve where the elasticity is measured.

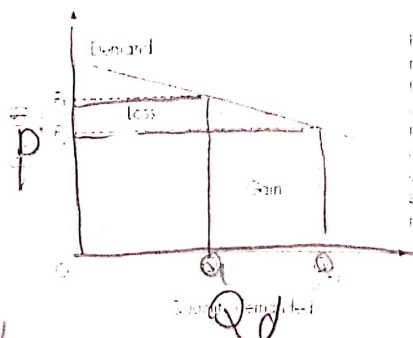
2. Practical Implication of PED

PED is helpful to:

1. Determine the Total Revenue gained by the firm
2. Determine the price stability of a product
3. Calculate the tax incidence on the consumers
4. Designing subsidies

1. Determine the Total Revenue gained by the firm

Definition | Total Revenue: It is the price multiplied by quantity. As we see from the diagram the change in total revenue. At price P1 the revenue was (OP1 x OQ1) at price P2 the revenue became (OP2 x OQ2).



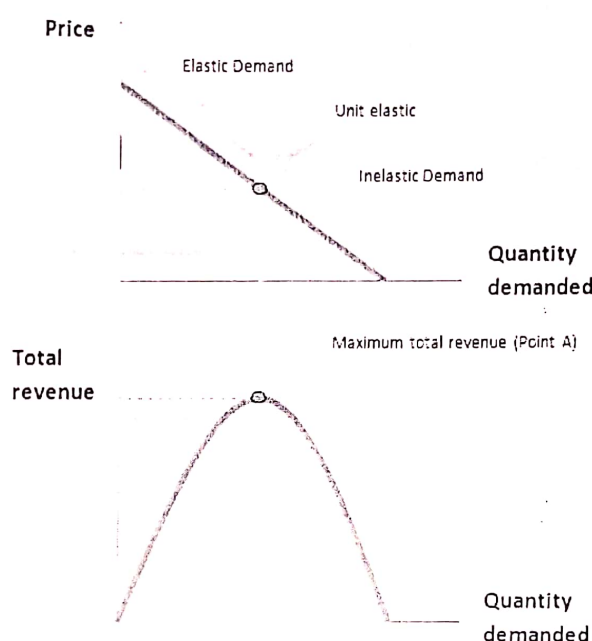
Here the demand curve is relatively price elastic (somewhat responsive to changes in price). A cut in price will therefore lead to a net gain in sales revenue. By contrast, if price were to increase, customers would simply switch to substitutes, thereby generating a net loss in sales revenue.

The demand curve is relatively price elastic. Somewhat responsive to changes in price. A cut in price will lead to a net gain in sales revenue. By contrast, if price were to increase, customers would switch to substitutes, thereby generating a net loss in sales revenue.

would switch to substitutes → loss in revenue

Price changes would leave different effects on price elastic, inelastic and unitary elastic demands

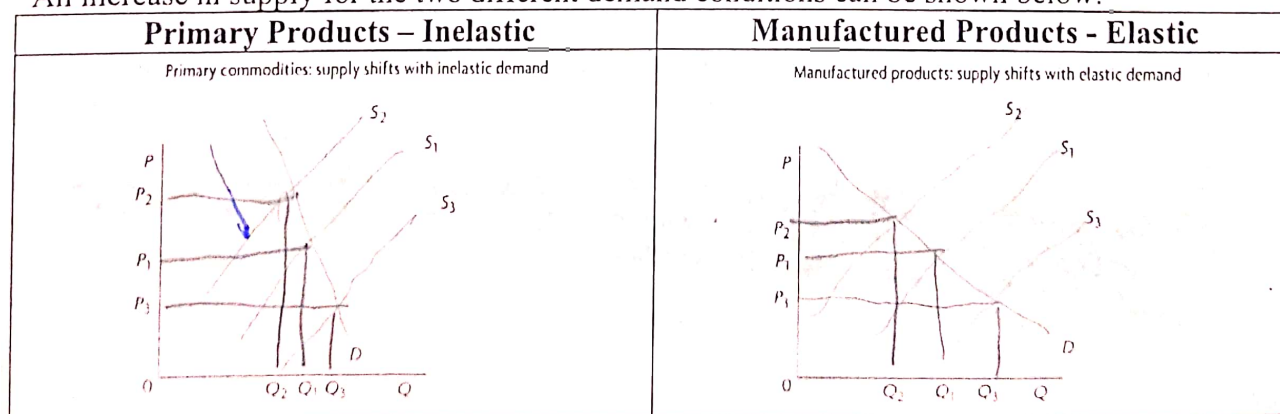
Factor	Description
1. Price Elastic	Any reduction in price would leave to increase in Total Revenue. Here the increase in quantity demanded insufficient to compensate for the decrease in price.
2. Unitary Elastic	On the midpoint the total revenue stops rising and is it at its maximum. There is no change in total revenue with a rise or fall in price of the product.
3. Price Inelastic	A decrease in price would lead to a decrease in total revenue. Here the increase in quantity demanded in insufficient to compensate for the decrease in price.



2. Determine the price stability of a product

PED contribute to the price fluctuations in the market. Primary products like raw material have inelastic demand because it is a necessity and it has no substitutes as compared to manufactured goods because though they may be necessities (in some cases), they usually do have substitutes.

An increase in supply for the two different demand conditions can be shown below:



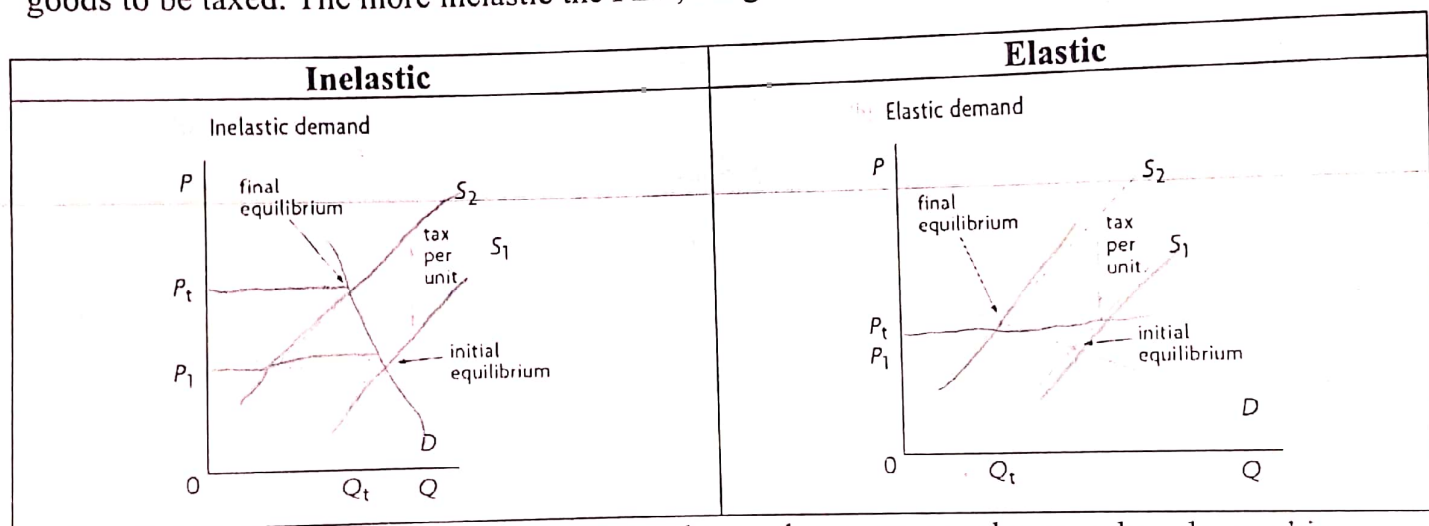
In case of primary products the decrease in price from P_2 to P_3 results in a smaller change in quantity consumed from Q_2 to Q_3 . Whereas in the case of manufactured products a decrease in price from P_2 to P_3 results in a greater change in quantity consumer from Q_2 to Q_3 . This shows us TWO things:

- (i) Prices of primary commodities can be highly volatile, whereas prices for manufactured products are more stable.
- (ii) It is more beneficial for primary producers to reduce supply to earn more total revenue hence government provides them with subsidies to make sure they are properly compensated.

3. Calculate the tax incidence on the consumers

Definition | Tax: A compulsory transfer payment from the private sector to the public sector. Direct taxes are directly imposed on the incomes and cannot be passed on however indirect taxes are imposed on the products and shift the supply curve to the left.

If governments are interested in increasing their tax revenues, they must consider the PED of the goods to be taxed. The more inelastic the PED, the greater the government tax revenues.



Note: When demand is inelastic more tax burden on the consumer, whereas when demand is elastic more tax burden on the producer. This concept will be further elaborated in Section 3.

4. Designing subsidies

Definition | Subsidy: A grant given by the government to the firms to increase their production and to reduce the prices so consumers can buy necessities at a cheaper price.

If the government wants to achieve its desired results it should give subsidies on products that have a more elastic supply or inelastic demand. Because in an inelastic demand it will reduce the price significantly whereas in elastic demand would fall only by a small proportion because of a subsidy.

5) PED allows the firm to practice price discrimination which means that the firm will charge more to the inelastic consumers and less to the elastic ones.

TOPIC 2: INCOME ELASTICITY OF DEMAND (YED)

Definition: It is the degree of responsiveness of quantity demanded to the change in income of consumers. YED can be categorized into THREE types on the bases of sign:

1. Positive YED (Normal Goods)
2. Negative YED (Inferior Goods)
3. Zero YED (Very Basic Necessities)

$$Y.E.D. = \frac{\% \text{ Change in Quantity Demanded}}{\% \text{ Change in Income}} = \frac{Q_2 - Q_1}{Y_2 - Y_1} \times \frac{Y_1}{Q_1}$$

Example: Suppose the income of a consumer increases from \$800 per month to \$1000 per month, and the purchases of clothes increase from \$100 to \$140 per month. What is the income elasticity of demand for clothes?

Answer:

$$Y_1 = \$800 \quad Y_2 = \$1000$$

$$Q_1 = \$100 \quad Q_2 = \$140$$

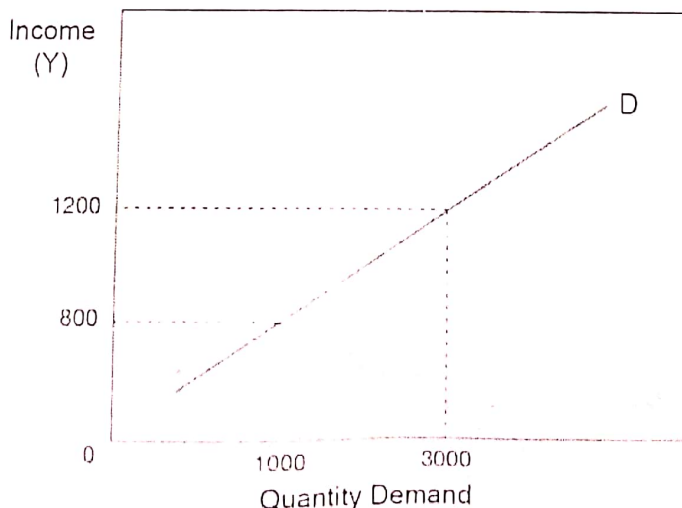
$$YED = \frac{\frac{40}{100}}{\frac{200}{800}} = \frac{0.40}{0.25} = +1.6$$

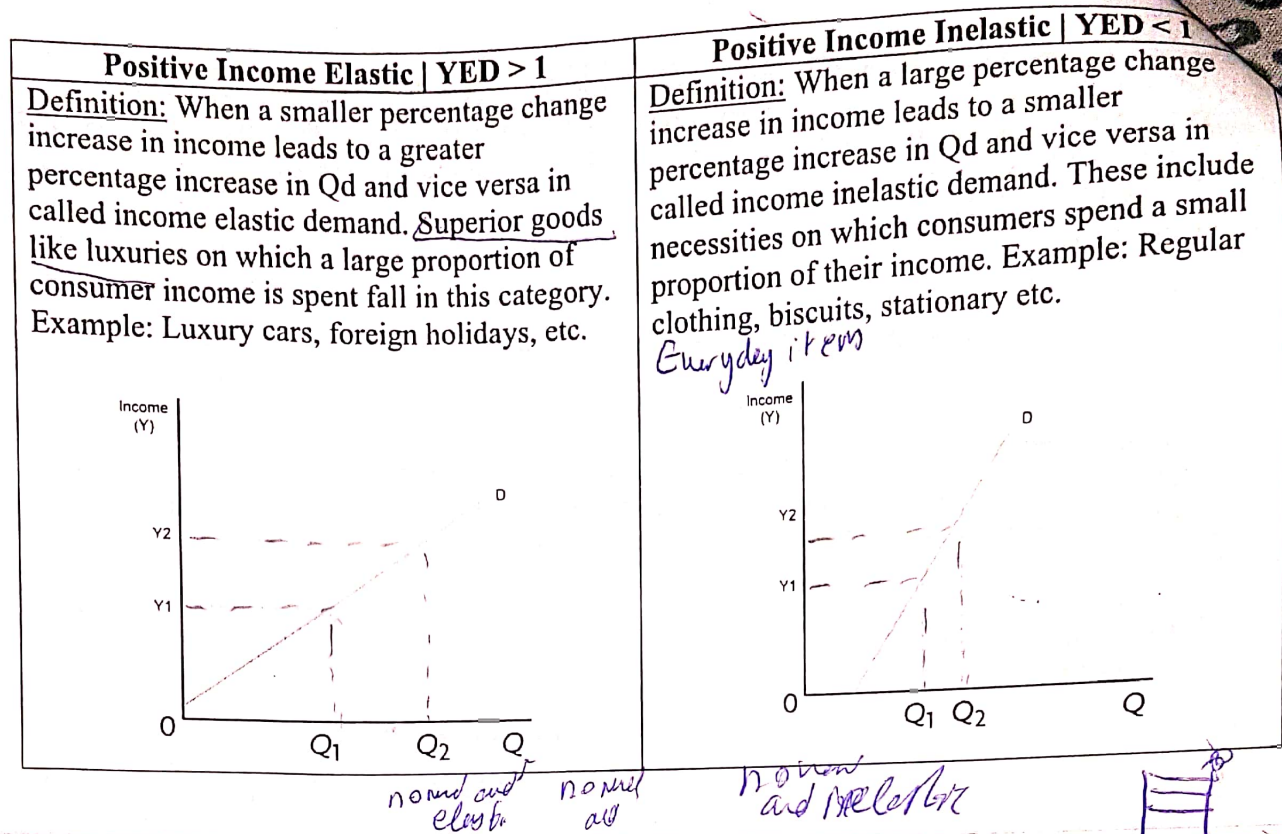
elasticity has nothing to do with the sign, it is always measured from one only tell the nature of the good

Note: In PED we ignored the sign but in case of YED the sign has great concern.

1. Positive YED (Normal Goods)

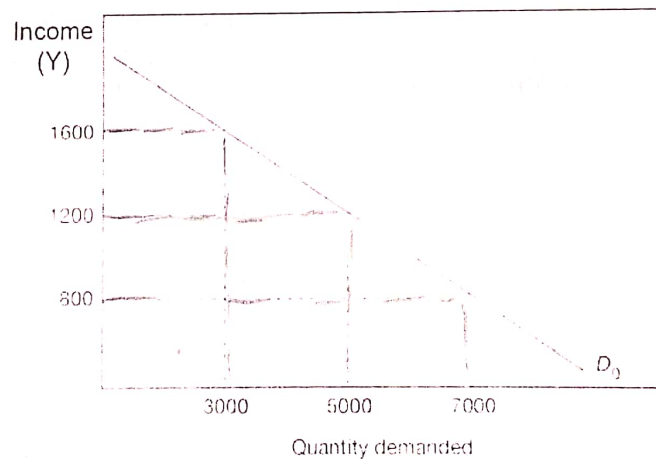
Definition: When an increase in income leads to an increase in Qd and a decrease in income leads to a decrease in Qd the YED is said to be positive because income and demand are moving in the same direction. Goods that have a positive YED are called normal goods, Example: Cars, TVs, mobiles etc. Positive YED can be either elastic or inelastic

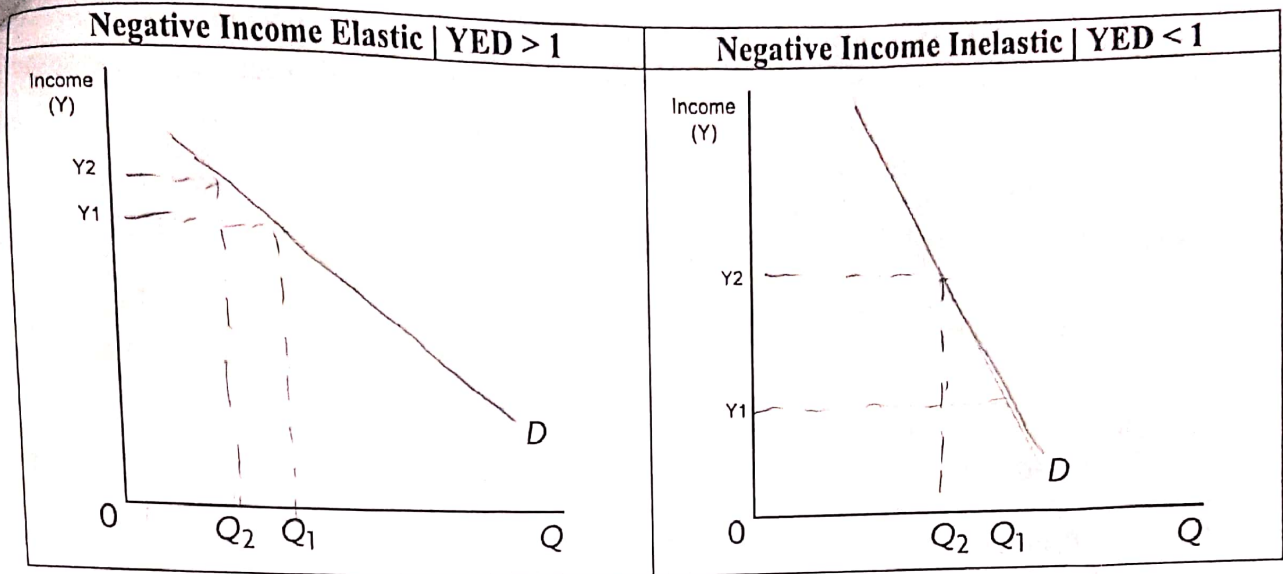




2. Negative YED (Inferior Goods)

Definition: When an increase in income leads to a decrease in demand of the product YED would be negative since income and demand are moving in the opposite direction. Goods that have a negative YED are called inferior goods, Example: second hand clothing, used cars. Negative YED can be either elastic or inelastic



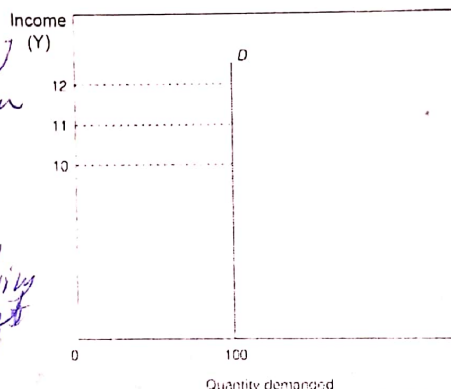


3. Zero YED (Very Basic Necessities)

Definition: When any percentage change in income leads to no change in demand. It is known as zero income elasticity of demand. Basic necessities like salt and sugar are examples. $YED = 0$.

The government needs to check the YED in order to calculate its tax revenue. In times of economic growth, the government would tax the normal goods to earn more tax revenue as the demand for more goods is high. When in times of recession, the govt might target inferior goods to earn more money. However, some governments might choose to not increase taxes on inferior goods in the hope of increasing the economy or to prevent a tax burden on poor people.

Uses of YED by govt



For the business, the YED tells which goods would be popular keeping the consideration of the economy. For normal goods, the demand will increase if the economy expands and the expansion of business is likely to undertake.

1. Practical Implication of YED

YED can help firms decide about the price and promotional activities in order to increase sales and profits.

Factor	Description
1. Economy – Boom/Year end	When the economy is growing people have more incomes and hence they will demand more normal and luxury goods and less of inferior goods. This also happens at year ends when salaries are paid and crops are sold. In this time companies should focus on producing luxuries and promote them by attractive displays and other promotional activities.
2. Economy – Recession	When the economy is experiencing slow economy growth or is experiencing a slump incomes are falling and hence at this point people are more interested in buying cheaper products. The firms should start producing cheaper version of products and advertise low prices and USPs.

Uses of YED by business

- Normal goods will increase marketing and will lead to develop new product lines to increase sales.
- Inferior goods would be more successful in times of recession as people would benefit more when incomes are low as they will use lower prices to attract consumers.

This allows provides guaranteed revenue tax on basic necessities

However, it is a regular since it might affect poor people. The government might not change as they are dependent on the market.

TOPIC 3: CROSS ELASTICITY OF DEMAND (XED)

Definition: It is defined as the responsiveness of quantity demanded of one good to the change in price of another good. XED can be categorized into THREE types:

1. Positive XED (Substitutes)
2. Negative XED (Complements)
3. Zero XED (Unrelated Goods)

$$\text{X.E.D.} = \frac{\% \text{ Change in Quantity Demanded for good A}}{\% \text{ Change in Price of Good B}} = \frac{Q_2 - Q_1}{Q_1} \times \frac{P_2}{P_1}$$

1. Positive XED (Substitutes)

Definition: Any proportionate change in price of a produce will cause an increase in the demand for its substitute and vice versa. Substitutes are those goods which are alternatively demanded.

Example: Pepsi and Coke, Nestle Juice and Shezan Juice, Tea and Coffee etc. Substitutes have a +ve XED. As when price of Pepsi will go up people will start consuming more coke since it provides almost the same utility.

Example: Suppose the price of coffee increases from \$10 per kilogram (kg) to \$12 per kg and the amount of tea purchased increases from 1500kg to 1650kg. What is the XED?

Answer:

$$P_1 = \$10 \quad P_2 = \$12$$

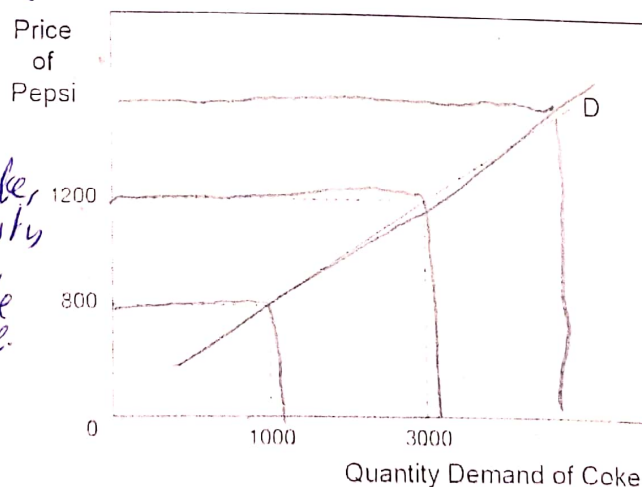
$$Q_1 = \$1500 \quad Q_2 = \$1650$$

$$\text{XED} = \frac{\frac{150}{1500}}{\frac{2}{10}} = \frac{0.1}{0.2} = +0.5$$

Note: A +ve XED shows that it is a substitute. Since when price of coffee went up people starting consuming more tea.

sign tells you about the good, as the elasticity tells us about the level of how close a substitute, complement is

The more elastic the value, the closer the substitute, the more inelastic the value, the less similar the substitute.



2. Negative XED (Complements)

Definition: Any proportionate increase in the price of a product will lead to a proportionate decrease in demand for its complement and vice versa. Compliments are those goods or services which are jointly demanded. Example: Car and Petrol, Bread and Butter etc. Complements have a -ve XED. As when price of petrol will go up people will start buying less cars since now affording a car is more expensive.

Example: Suppose the price of pencils increases from \$1.00 per pencil to \$1.30 and the quantity of erasers purchased falls from 1000 erasers to 800. What is the XED?

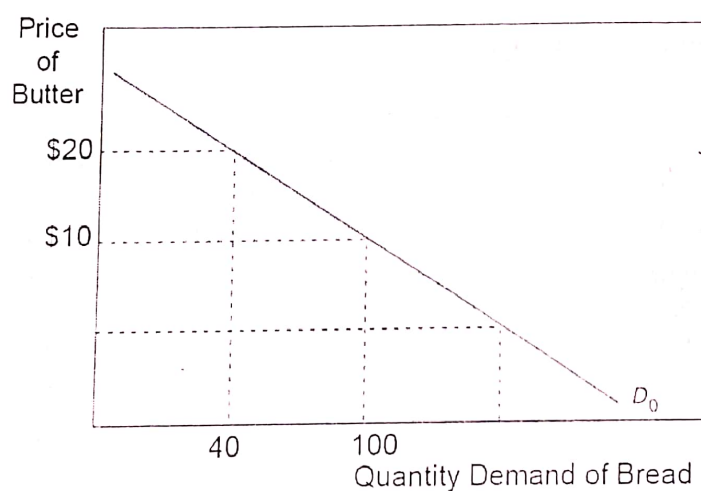
Answer:

$$P_1 = \$1 \quad P_2 = \$1.3$$

$$Q_1 = 1000 \quad Q_2 = 800$$

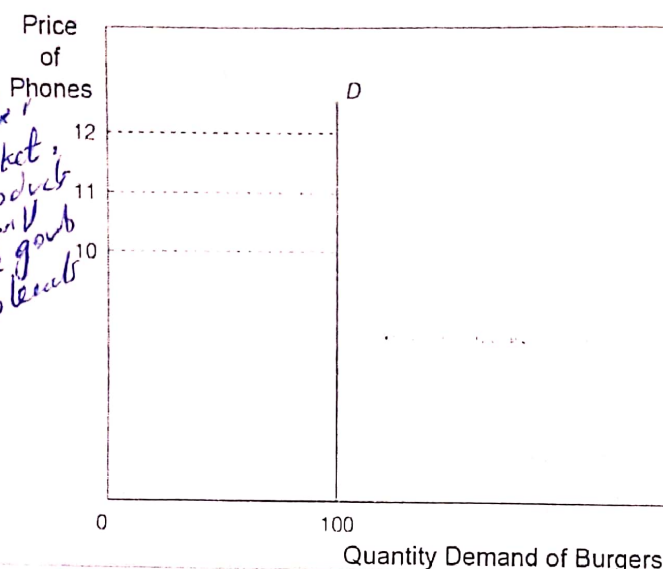
$$XED = \frac{\frac{-200}{1000}}{\frac{0.30}{1.00}} = \frac{-0.20}{0.30} = -0.67$$

Note: A -ve XED shows that it is a compliment. Since when price of pencils went up the demand for erasers dropped as without a pencil an eraser is not much of any use.



3. Zero XED (Unrelated Goods)

Definition: Any proportionate increase or decrease in price of one product generates no response in the quantity demanded of another product, these types of goods are unrelated. Unrelated goods are those goods which have no link with each other. Example: shirts and burgers, potatoes and telephones etc. Unrelated goods have a 0 XED. As these goods will neither be substitutes nor complements.



1. Practical Implication of XED

Factor	Description
1. Price change in substitutes <i>The ideal position for business, when the substitute increases the price of the complement decreases the price.</i>	If the price of coffee rises, tea sellers should realize that consumers will buy more tea and they should launch more advertisement campaigns to increase sales. Furthermore if coffee prices increase tea seller might also increase their prices to gain extra profits. Similarly if the price of coffee falls, tea sellers might have to give discounts or coupons to stop the individuals from shifting to coffee. Furthermore they might even have to decrease their prices which will reduce profitability.
2. Price change in complements	If the price of butter falls, a bread seller might increase his sales. The bread seller will advertise more and offer variety and promotional campaigns. If the price of butter increases, a bread seller sales might decrease. Hence he might need to give discounts and offer special offers like buy one get one free to prevent a drop in sales.

*Uks : 12 mark
general : 8 mark
concept :*

TOPIC 4: PRICE ELASTICITY OF SUPPLY (PES)

Definition: PES is defined as the degree of responsiveness of Quantity Supplied due to the change in price of a product. A high PES would show that the suppliers can quickly increase the supply if there is an increase in price. This helps the firm gain a competitive edge and be more flexible to the price changes.

$$PES = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}} = \frac{\frac{Q_{s2} - Q_{s1}}{Q_{s1}}}{\frac{P_2 - P_1}{P_1}} = \frac{Q_{s2} - Q_{s1}}{P_2 - P_1} \times \frac{P_1}{Q_{s1}}$$

Example: Suppose the price of strawberries increases from \$3 per kg to \$3.50 per kg, and the quantity of strawberries supplied increases from 1000 to 1100 tonnes per season. Calculate PES for strawberries.

Answer:

$$P_1 = \$3 \quad P_2 = \$3.5$$

$$Q_1 = 1000 \quad Q_2 = 1100$$

$$PES = \frac{\frac{100}{1000}}{\frac{0.50}{3.00}} = \frac{0.10}{0.17} = +0.59$$

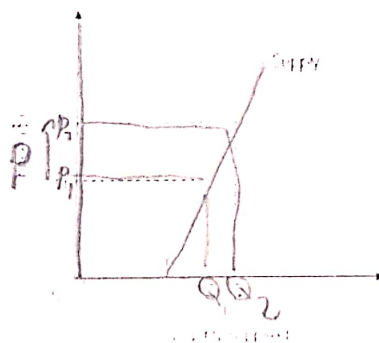
Note: Since the answer is less than 1, the PES is inelastic

Interpreting PES calculations

1. Inelastic Supply
2. Elastic Supply
3. Perfectly Inelastic Supply
4. Perfectly Elastic Supply
5. Unitary Elastic Supply

1. Inelastic Supply | $PES < 1$ = Inelastic

Definition: If the price change causes a smaller proportionate change in quantity supplied the supply is said to be price inelastic. Example: Price went up by 10% however supply increased by only 5%. In other words if $PES < 1$ = Inelastic

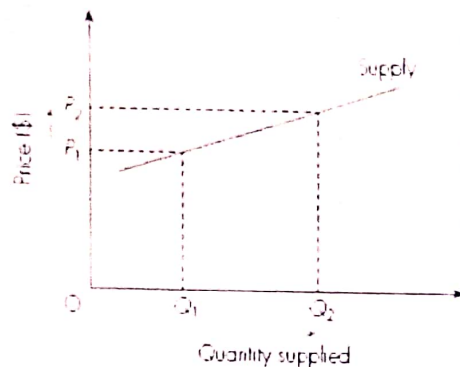


In this case, when price rises from P_1 to P_2 , there is very little spare capacity for the firm, so the quantity supplied can only rise by a smaller proportion from Q_1 to Q_2 . Examples are fresh fruit and vegetables that take time to grow so supply is relatively unresponsive to changes in price.

When price rises from $P_1 \rightarrow P_2$, there's very little spare capacity, so Q_s can only rise by a small proportion from Q_1 to Q_2 . e.g. fresh fruit.

2. Elastic Supply | $PES > 1$ = Elastic

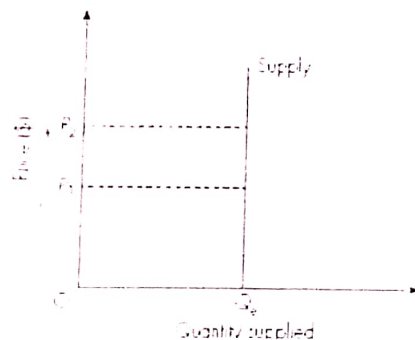
Definition: If the price change causes a greater proportionate change in quantity supplied the supply is said to be price elastic. Example: Price went up by 10% however the supply decreased by 15%. In other words, $PES > 1$ = Elastic



In this case, when price rises from P_1 to P_2 , there is plenty of spare capacity for the firm, so the quantity supplied can increase by a greater proportion from Q_1 to Q_2 , i.e. supply is price elastic. Examples of products with price elastic supply are mass-produced goods such as carbonated soft drinks and tooth paste.

3. Perfectly Inelastic Supply | $PES = 0$

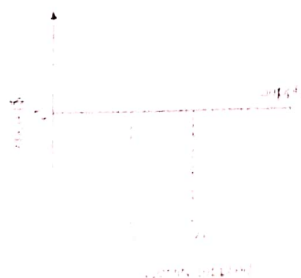
Definition: This is a theoretical possibility where a change in price has no impact on the quantity supplied. Example: Price went up by 20% however the supply stayed the same. In other words, $PES = 0$ = Perfectly Inelastic. This shows that there is not spare capacity in the economy due to which suppliers are unable to increase the supply even when the price increases.



Here, supply is perfectly price inelastic at Q_1 . Irrespective of price changes, the firm can only supply a maximum of Q_1 , so changes in price have no impact on the quantity supplied, i.e. $PES = 0$. An example is a football stadium or a concert hall that cannot accommodate more than the seating capacity.

4. Perfectly Elastic | $PED = \text{infinity } (\infty)$

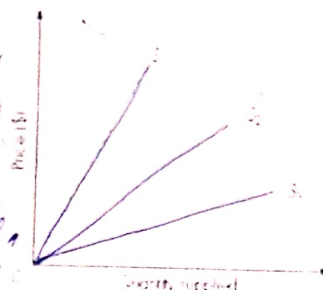
Definition: This is a theoretical possibility where the supply can change without any corresponding change in price. If the price increase from that point it will lead to zero quantity supplied. Example: Price stayed the same, the quantity supplied increased by 10%. In other words, $PED = \text{infinity } (\infty)$. This shows that there is spare capacity in the economy and the suppliers can increase the supply without increasing the price.



Here, supply is perfectly price elastic at price P_1 . For example, farmers can grow a huge amount of potatoes, and increase it without affecting the price. As long as the price is high enough, they will produce as much as they want. Without the price being raised, there is no incentive to produce more. However, if the price is raised, they will produce more.

5. Unitary Elastic | $PED = 1$

Definition: This is a theoretical possibility where the percentage change in price leads to the same proportionate change in quantity supplied. Example: Price increased by 10% and quantity supplied increased by 10%. In other words, $PED = 1$.



Determinants of Price Elasticity of Supply

Factors	Description
1. Level of Spare Capacity	When the industry is operating below full capacity, this shows that it has unemployed resources. Industry can expand easily by using the previously unused resources and that would make the supply elastic. However, at full capacity no spare resources in the industry which makes expansion difficult making the supply inelastic.
2. Number of producers in the industry	More the suppliers in the industry the <u>elastic</u> would be the supply since as soon as the price goes up more producers would start supplying. However, if there are more barriers to entry, supply would be inelastic.
3. Time Period	In the <u>short run</u> firms, cannot change their factors of production making the supply inelastic. In the <u>long run</u> supply, would be elastic since level of production can change their factors of production.
4. Ease and Cost of Factor Substitution	This shows to what extent can labor and capital be switched. If switching is easy and quick this will make the supply elastic. However, if switching is difficult supply would be inelastic.
5. Availability to Import	If a country can import raw-material, machines etc. from abroad easily and cheaply supply would be elastic. However, if the country is a closed economy or the international barriers to import are high supply would be inelastic.
6. Ability to Store the Product	If products can be <u>stored easily</u> and cheaply supply would be elastic since when prices are low the supply can be reduced and as soon as the prices increase supply can be increased.

Note: Governments sometimes tend to control these factors to increase the elasticity of supply of a product. The govt. is able to achieve these using methods like:

1. Government can provide subsidy to the firms
2. Training of workers
3. Research & Development
4. Invest in Infrastructure