



# Cambridge (CIE) A Level Economics



Your notes

## Elasticities of Demand

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- \* Price Elasticity of Demand (PED)
- \* Using Price Elasticity of Demand (PED)
- \* Income Elasticity of Demand (YED)
- \* Cross Elasticity of Demand (XED)



# Defining and calculating PED

- The **law of demand** states that when there is an increase in price, there will be a fall in the quantity demanded
  - Economists are interested **by how much** the **quantity demanded will fall**
- **Price elasticity of demand** reveals how **responsive** the change in **quantity demanded** is to a change in **price**
  - The responsiveness is different for different types of products

## Calculating PED

- **PED can be calculated** using the following formula:

$$\text{PED} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}} = \frac{\% \Delta \text{ in QD}}{\% \Delta \text{ in P}}$$

- **To calculate a % change**, use the following formula:

$$\% \text{ Change} = \frac{\text{new value} - \text{old value}}{\text{old value}} \times 100$$



### Worked Example

A firm **raises** the price of its products from \$10 to \$15. Its **sales fall** from 100 to 40 units per day. Calculate the **PED** of its products

**Step 1: Calculate the % change in QD**

$$\% \Delta \text{ QD} = \frac{40 - 100}{100} \times 100$$

$$\% \Delta \text{ QD} = -60\%$$

**Step 2: Calculate the % change in P**

$$\% \Delta \text{ P} = \frac{15 - 10}{10} \times 100$$

$$\% \Delta \text{ P} = 50\%$$

**Step 3: Insert the above values in the PED formula**



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$$PED = \frac{\% \Delta \text{ in QD}}{\% \Delta \text{ in P}}$$

$$PED = \frac{-60}{50}$$

$$PED = -1.2$$

**Step 4: Final answer = -1.2**



### Examiner Tips and Tricks

If you are given the PED value and the %Δ in Price and then asked to find the %Δ in Qd, follow the standard maths procedure as follows:

1. Substitute the values provided into the equation
2. Substitute X for %Δ in Qd
3. Solve for X

Remember the phrase 'Ducks on the Pond' so that you always put the percentage change in demand (D for ducks) on top of the percentage change in price (P for pond)



### Worked Example

The price elasticity of demand for smartphones is -2. It can be concluded that a 10% reduction in their price would be a percentage change in demand of:

- A. -7.4%
- B. -20.0%
- C. +7.4%
- D. +20.0%

**Step 1: Substitute the values provided into the equation**

$$PED = \frac{\% \Delta \text{ in QD}}{\% \Delta \text{ in P}}$$

**Step 2: Substitute X for %Δ in Qd**

$$+2 = \frac{X}{-10\%}$$

**Step 3. Solve for X**

$$X = 20\%$$

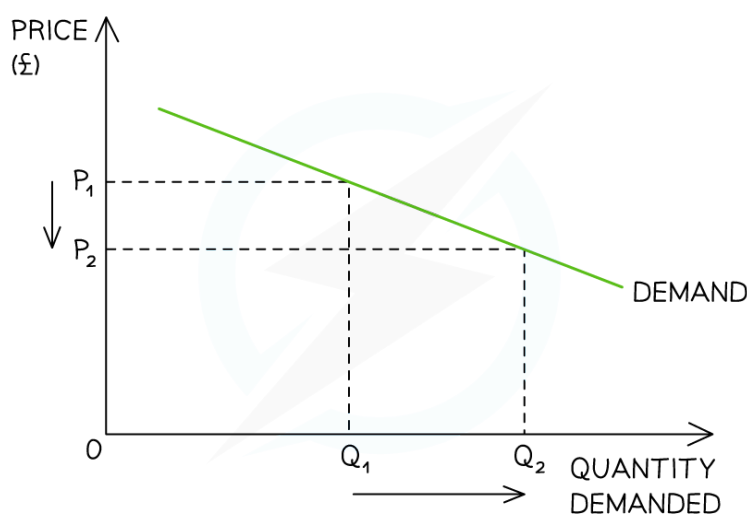


# Interpreting PED values

- The results of the price elasticity of demand calculation tell us **how responsive consumers are to a change in price**

## 1. Price elastic demand

- The value of PED:  $-1 \rightarrow \infty$
- The percentage change in quantity demanded is **more than proportional** to the percentage change in price



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**Consumers are very responsive to price changes**

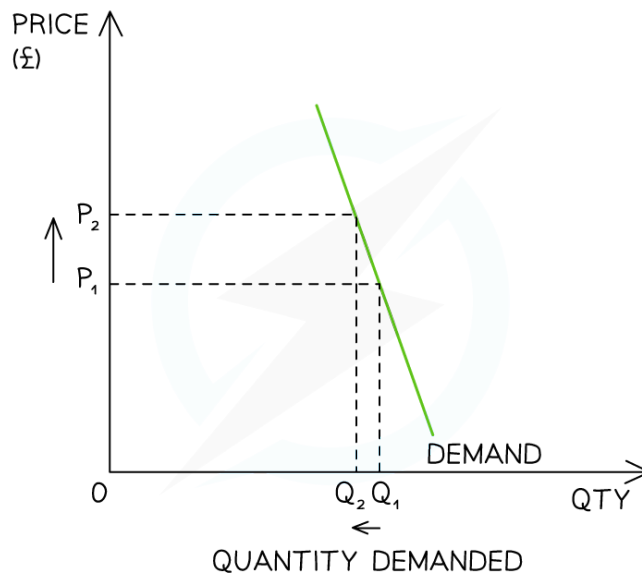
- Consumers are **very responsive** to price changes
  - For example, a small price cut on airline tickets in Malaysia can lead to a large rise in bookings

## 2. Price inelastic demand

- The value of PED:  $0 \rightarrow -1$
- The percentage change in quantity demanded is **less than** proportional to the percentage change in price



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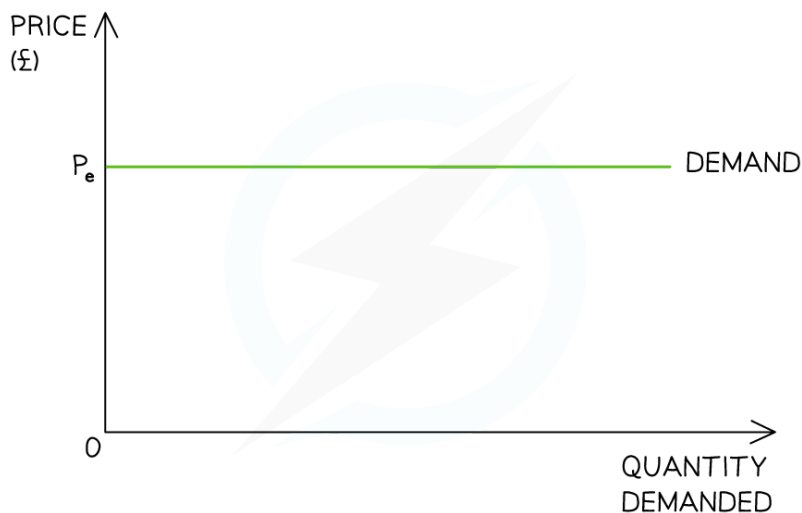


**Price inelastic demand**

- Consumers are relatively unresponsive to price changes
  - They may consider the product to be a **necessity**
- For example, cigarette sales in Indonesia fall only slightly when prices rise – demand is inelastic

### 3. Perfectly elastic demand

- The value of PED:  $\infty$
- The quantity demanded will **fall to zero** with any percentage change in price (highly theoretical elasticity)



**Perfectly elastic demand**

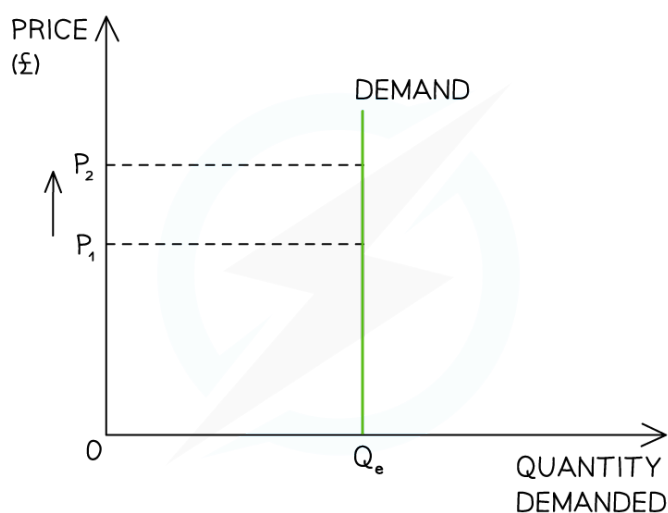
- Buyers will only purchase at **one price**, and any change causes demand to drop to zero
- For example, on global stock markets, traders may **only buy a share at a specific price**, not higher



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## 4. Perfectly inelastic demand

- The value of PED: 0
- The quantity demanded is **completely unresponsive** to a change in price (very theoretical value)



*Consumers are entirely unresponsive to a change in price*

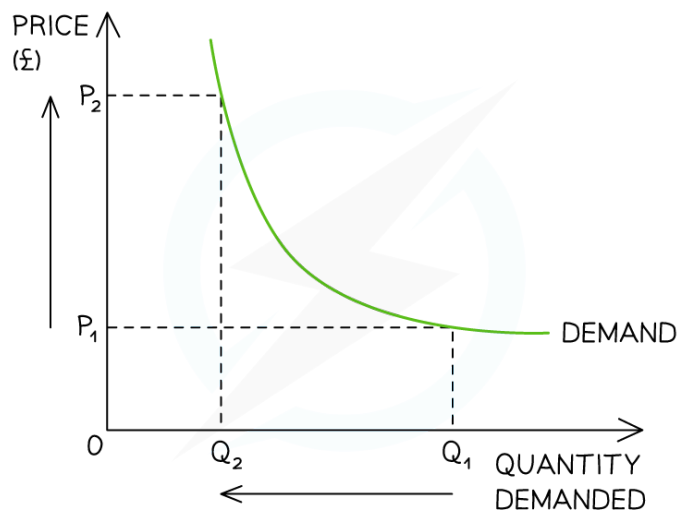
- For example, a patient needing life-saving insulin in India will buy it regardless of price

## 5. Unitary elasticity

- The value of PED: 1
- The percentage change in quantity demanded is **exactly equal** to the percentage change in price



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**Consumer respond proportionally to any price changes**

- A 5% rise in the price of a basic mobile plan in Egypt causes a 5% drop in subscriptions



### Examiner Tips and Tricks

The PED value will **always be negative**, so the answer must clearly state this. However, to explain the degree of elasticity, ignore the minus sign to apply the values

When the PED value is **closer to zero**, it is becoming **very inelastic**, e.g.,  $(-)0.1$ . The **higher the value is above 1**, the more elastic demand becomes. e.g.,  $(-)5$

## The determinants of PED

- Some products are more responsive to **changes in prices** than other products
- The factors that determine responsiveness are called the **determinants of PED** and include

S

P

L

A

T



Availability  
of substitutes



Prices of  
product as  
a proportion  
of income



Luxury or  
necessity



Addictiveness  
of the product



Time  
period

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## S – Availability of substitutes

- Good availability of substitutes results in a **higher value of PED** (relatively elastic)

## P – Price of product as a proportion of income

- The lower the proportion of income the price represents, the **lower the PED value will be**
- Consumers are less responsive to price changes on cheap products (relatively inelastic)

## L – Luxury or necessity

- Luxury goods are more elastic because they are not essential, while necessities are more inelastic because consumers have no choice but to buy them.

## A – Addictiveness of the product

- Addictiveness turns products into necessities, resulting in a **low value of PED** (relatively inelastic)

## T – Time period

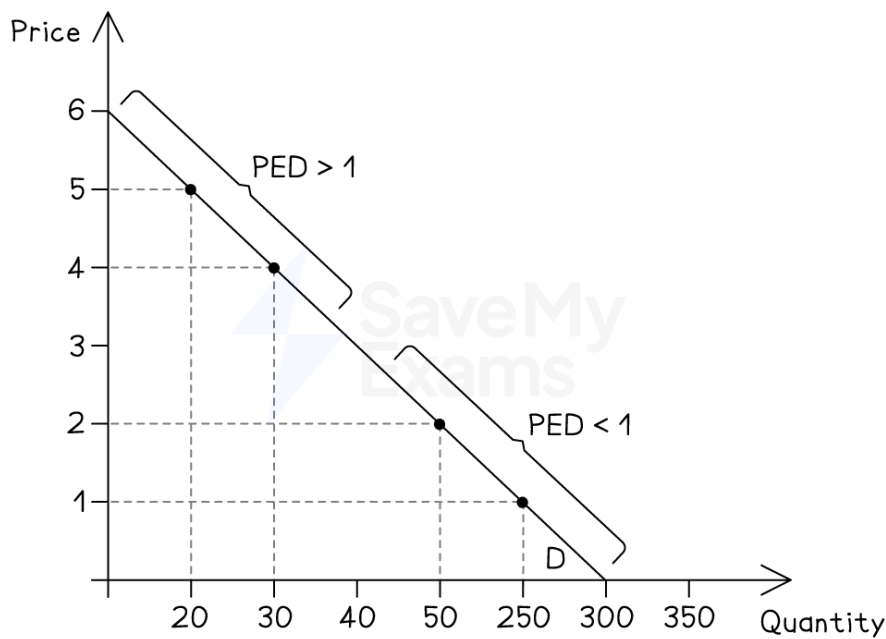
- In the short term, consumers are less responsive to price increases, resulting in a **low value of PED** (relatively inelastic)
- Over a longer period of time, consumers may feel the price increase more and will then look for substitutes, resulting in a **higher value of PED** (relatively elastic)

## Variation in PED along a straight-line curve

- PED **varies along the length of a straight-line demand curve**
- The **slope is constant**, but **elasticity changes**



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The PED varies along a straight line curve

## Diagram analysis

### Top of the demand curve

- Demand is **price elastic**
- $PED > 1$
- Small price changes cause large percentage changes in quantity demanded

### Middle of the demand curve

- Demand is **unit elastic**
- $PED = 1$
- Percentage change in price equals percentage change in quantity demanded

### Bottom of the demand curve

- Demand is **price inelastic**
- $PED < 1$
- Price changes cause relatively small percentage changes in quantity demanded



### Examiner Tips and Tricks

Do not confuse **slope** with **elasticity**

Same slope  $\neq$  same elasticity

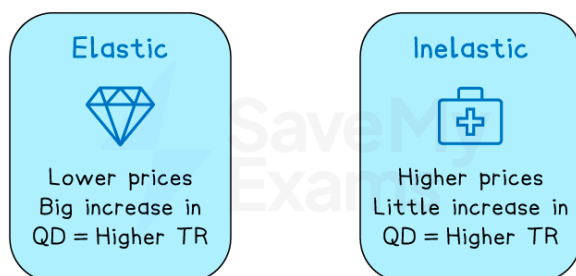


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# PED and total expenditure/revenue

- **Revenue** is the amount of money a firm receives from selling its goods or services
  - Total revenue = price x quantity
  - Also referred to as **consumer expenditure** from the buyer's perspective
- The **total revenue rule** states that in order to **maximise revenue**, firms should **increase** the price of products that are **inelastic** in demand, and **decrease** prices on products that are **elastic** in demand

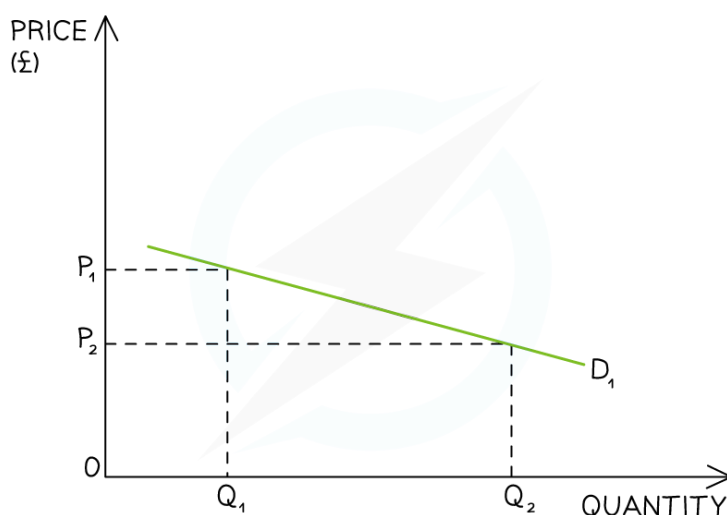


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**The total revenue rule**

## 1. Lowering price for elastic demand

- The demand curve is very **elastic** in this market



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**Price elastic demand where a small decrease in price from P<sub>1</sub> → P<sub>2</sub> causes a large increase in revenue**

## Diagram analysis

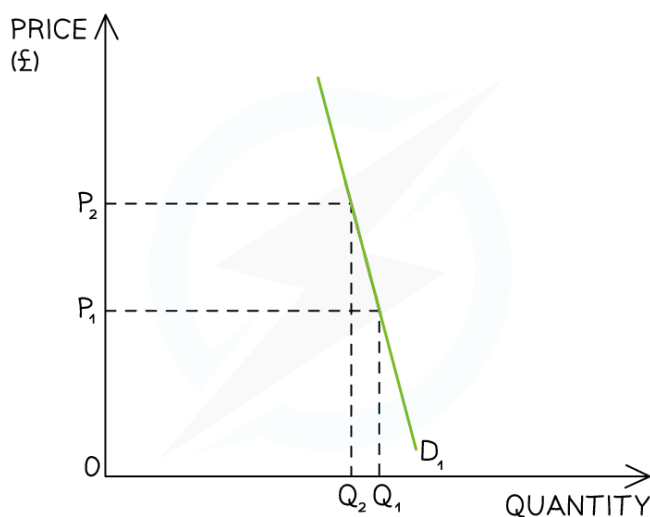
- When a good or service is **price elastic in demand**, there is a greater than proportional increase in the quantity demanded to a decrease in price
- **Total revenue is higher** once the price has been **decreased** from  $P_1$  to  $P_2$ 
  - $(P_2 \times Q_2) > (P_1 \times Q_1)$



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## 2. Raising price for inelastic demand

- The demand curve is very **inelastic** in this market



*Price inelastic demand where a large increase in price from  $P_1 \rightarrow P_2$  raises revenue*

### Diagram analysis

- The demand curve is very inelastic in this market
- When a good/service is **price inelastic in demand**, there is a smaller-than-proportional decrease in the quantity demanded to an increase in price
- **Total revenue is higher** once the price has been **increased**
  - $(P_2 \times Q_2) > (P_1 \times Q_1)$



### Worked Example

A firm **raises** the price of its products from £10 to £15. Sales **have fallen** from 100 to 40 units per day. Explain if the firm has made the correct decision

**Step 1: Calculate the initial sales revenue**

$$\begin{aligned}
 \text{Sales Revenue} &= \text{Price of product X} \times \text{Quantity sold} \\
 &= £10 \times 100 \\
 &= £1,000
 \end{aligned}$$



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### Step 2: Calculate the sales revenue after the price change

$$\begin{aligned}
 \text{Sales Revenue} &= \text{Price of product X} \times \text{Quantity sold} \\
 &= £15 \times 40 \\
 &= £600
 \end{aligned}$$

### Step 3: Explain the decision

- By raising the price, **total revenue** has fallen by £400
- This indicates that the product is **price elastic** in demand
- The firm **should have lowered their price** in order to maximise revenue



### Examiner Tips and Tricks

A common error students make is to say that when prices increase and the product is inelastic in demand, the quantity demanded does not fall. **It does**, but it is a **less than proportional change** than the increase in price.

When governments tax demerit goods such as cigarettes, the increase in price is greater than the decrease in QD, but QD still falls.

## Using PED in decision-making

### 1. Strategic pricing decisions

- Businesses can use PED insights to guide pricing strategies:
  - If demand is **inelastic**, raising prices can boost revenue
  - If demand is **elastic**, lowering prices may increase sales volume and overall revenue

### 2. Making demand less sensitive to price

- Firms often aim to reduce price sensitivity to strengthen revenue potential. Strategies include:
  - **Persuasive advertising**: Highlighting unique benefits or endorsements to make products more appealing than alternatives
  - **Branding**: Creating a strong brand identity to differentiate from competitors and build customer loyalty
  - **Mergers and acquisitions**: Expanding market control by joining forces with competitors



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- **Monopoly creation:** Securing exclusive rights through patents or regulation to limit competition and control pricing
- **Knowledge of PED** is important to **firms** seeking to **maximise their revenue**
  - Sales revenue will be maximised
    - If their product is **price inelastic in demand**, they should **raise their prices**
    - If their product is **price elastic** in demand, then they should **lower their prices**
    - Firms **lower their prices** for **elastic** sections of their market, e.g., off-peak train travel
    - Firms **increase prices** for **inelastic** sections of their market, e.g., peak hour train travel

### 3. The implications of PED for governments

- **Knowledge of PED** is important to **Governments** with regard to **taxation and subsidies**
  - If governments **tax price-inelastic products**, they can raise tax revenue without harming firms too much
    - Consumers are less responsive to price changes so **firms will pass on the tax** to the consumer
  - If Governments **subsidise** price-elastic-in-demand products, there can be a **greater-than-proportional increase** in the quantity demanded
    - This strategy is especially good for encouraging consumption of **merit goods** such as electric vehicles



# Defining and calculating YED

- **Changes in income** result in changes to the **demand** for goods/services
  - Economists are interested in **how much** the **quantity demanded will change** for different products
- **Income elasticity of demand (YED)** reveals how **responsive** the change in **quantity demanded** is to a change in **income**

## Calculation of YED

- YED can be calculated using the following formula:

$$\text{YED} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}} = \frac{\% \Delta \text{ in QD}}{\% \Delta \text{ in Y}}$$



### Worked Example

A consumer's **income rises** from £100 to £125 a week. They originally consumed 12 bagels at the local bakery, but this **increased** to 15 bagels a week.

Calculate the **YED** of the bagels

**Step 1: Calculate the % change in QD**

$$\% \Delta \text{ QD} = \frac{15 - 12}{12} \times 100$$

$$\% \Delta \text{ QD} = +25\%$$

**Step 2: Calculate the % change in Y**

$$\% \Delta Y = \frac{125 - 100}{100} \times 100$$

$$\% \Delta Y = +25\%$$

**Step 3: Insert the above values in the YED formula**



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$$PED = \frac{\% \Delta \text{ in QD}}{\% \Delta \text{ in Y}}$$

$$YED = \frac{25}{25}$$

$$YED = + 1$$

Even when the YED value is positive, the answer must clearly state this

## Interpreting YED values

- The YED value can be positive or negative and the value is important in determining the type of good
  - A good with a **positive YED** value is considered to be a **normal good**
    - Normal goods can be classified as **necessities** or **luxuries**
  - A good with a **negative YED** value is considered to be an **inferior good**

### The meaning of YED values

| Value                                     | Explanation                                                                                                                                                                                                           |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>0→1</b><br><b>Normal necessity</b>     | <ul style="list-style-type: none"><li>▪ Demand increases proportionately less when income increases</li><li>▪ Income inelastic, which means that demand is relatively less responsive to a change in income</li></ul> |
| <b>YED &gt; 1</b><br><b>Normal luxury</b> | <ul style="list-style-type: none"><li>▪ Demand increases proportionately more when income increases</li><li>▪ Income elastic, which means demand is relatively more responsive to a change in income</li></ul>        |
| <b>YED &lt; 0</b><br><b>Inferior good</b> | <ul style="list-style-type: none"><li>▪ Demand decreases when income increases or vice versa so YED is negative</li></ul>                                                                                             |

## Factors affecting YED

- YED is influenced by **any factors in an economy** which change the wages of workers
  - During a **recession** wages usually fall and demand for **inferior goods** rises while demand for **luxury goods** falls
  - During a period of **economic growth** and rising wages, demand for luxury goods increases while demand for inferior goods decreases

- Other influences on income include **minimum wage legislation, taxation, increased international trade**



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## Normal goods

- These are items people tend to buy more of as their income rises. For example, as household earnings grow, purchases of fresh produce or home appliances may increase
- Normal goods have a **positive YED**, indicating a rise in demand when income increases or vice versa

## Inferior goods

- Demand for these products tends to fall when income goes up, as consumers switch to higher-quality alternatives
  - For instance, instant noodles or budget laundry detergent might be replaced by premium brands.
- Inferior goods have a **negative YED**, and the size of the value reflects how strongly demand reacts to income changes

## Necessities

- These are essential items that people continue to buy despite income changes
  - Examples include staple foods like bread or cooking oil
- They are **normal goods**, as their **YED is positive but close to zero**, showing that demand responds by a smaller percentage than the percentage change in income

## Luxury or superior goods

- These **normal goods** see a significantly greater percentage rise in demand as income increases
  - Designer handbags, high-end electronics, or gourmet dining experiences fall into this category
- They have a **YED greater than 1**, meaning demand is highly responsive to income growth



### Examiner Tips and Tricks

You should consider that the classification of a good can vary depending on the consumer's income. For example, public transport might be a necessity for lower-income households but considered an inferior option by wealthier individuals who prefer private vehicles

## Implications for decision-making of YED

- YED is crucial for firms as it helps them **understand consumer behaviour**, analyse markets, plan strategies, make informed investment decisions, and **adapt to changes in**

### the sectoral structure of the economy



Your notes

- By assessing the income elasticity of demand, firms can effectively navigate evolving market dynamics and **position themselves for sustainable growth**
- In **developing countries** such as **India, China, Malaysia, and Pakistan**, rising incomes often lead to increased demand for personal vehicles. **As people upgrade** from basic models to premium brands, **manufacturers respond by expanding production facilities**

## For firms

- Products with **high positive YED** are luxury goods
  - Demand rises more than proportionately as incomes increase
  - Firms may target high-income consumers during periods of economic growth
- Products with **low positive YED** are normal necessities
  - Demand rises slowly as income increases
  - Firms may expect stable sales even if incomes rise
- Products with **negative YED** are inferior goods
  - Demand falls as incomes increase
  - Firms may face declining sales as living standards improve

## For governments

- YED helps predict how demand for goods and services changes during economic growth or recession
- Goods with high YED may experience large fluctuations in demand over the business cycle
- Demand for necessities with low YED is more stable, which is important for planning public services

## For the economy

- High YED products contribute more to economic growth during expansions
- Industries producing inferior goods may decline as incomes rise



# Defining and calculating XED

- Changes in the prices of **complementary goods** and **substitutes** affect the demand for related products
- Cross price elasticity of demand (XED)** reveals how **responsive** the change in **quantity demanded for good A** is to a change in **price of good B**
  - The responsiveness is different for different types of products
- XED can be calculated** using the following formula:

$$\text{XED} = \frac{\% \text{ change in quantity demanded of good A}}{\% \text{ change in price of good B}} = \frac{\% \Delta \text{ in } QD_A}{\% \Delta \text{ in } P_B}$$



### Worked Example

Leading into the release of *FIFA 22 Ultimate*, EA Sports **discounted** the price of *FIFA 21* from £90 to £60. A game store in Winchester saw an **increase in sales** of their PlayStation 5 consoles. Prior to the discount, they were selling 50 units a week, and **after the discount** this increased to 80 units.

Calculate the XED and explain the relationship between the two products

**Step 1: Calculate the % change in  $QD_A$**

$$\% \Delta QD_A = \frac{80 - 50}{50} \times 100$$

$$\% \Delta QD_A = 60\%$$

**Step 2: Calculate the % change in  $P_B$**

$$\% \Delta P_B = \frac{60 - 90}{90} \times 100$$

$$\% \Delta P_B = -33.3\%$$

**Step 3: Insert the above values in the XED formula**



Your notes

$$XED = \frac{\% \Delta \text{ in } QD_A}{\% \Delta \text{ in } P_B}$$

$$XED = \frac{60\%}{-33.3\%}$$

$$XED = -1.8$$

#### Step 4: Explain the relationship between the two products

The **negative sign** indicates that these two products are **complements** and the high value suggests they are **strong complements**



#### Worked Example

The price of good Y, a substitute for X, rises from £50 to £60. As a result, the quantity demanded of good X rises from 2 units to 3 units per month.

What is the value of the cross elasticity of demand for good X with respect to Y?

- A: +0.4
- B: -0.4
- C: +2.5
- D: -2.5

#### Step 1: Calculate % change in $QD_A$ using formula

$$\% \Delta QD_A = \frac{3-2}{2} \times 100$$

$$\% \Delta QD_A = 50\%$$

#### Step 2: Calculate % change in $P_B$ using formula

$$\% \Delta P_B = \frac{60-50}{50} \times 100$$

$$\% \Delta P_B = 20\%$$

#### Step 3: Insert the above values in the XED formula



Your notes

$$XED = \frac{\% \Delta \text{ in } QD_A}{\% \Delta \text{ in } P_B}$$

$$XED = \frac{+50\%}{+20\%}$$

$$XED = +2.5$$

The positive **sign** indicates that these two products are **substitutes** and the high value suggests they are **strong substitutes**

## Interpreting the XED coefficient

- Economists use the concept of **Cross Elasticity of Demand (XED)** to measure how the demand for one product responds when the price of another changes.
- The sign and size of XED reveal whether goods are substitutes, complements, or unrelated

### Identifying complements, substitutes, and unrelated goods

| Value                                                        | Explanation                                                                                                                                                                                                 |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><math>XED &lt; 0</math></b><br><b>Complementary goods</b> | <ul style="list-style-type: none"><li>▪ The <b>negative</b> value indicates the two goods are complements</li><li>▪ The <b>higher</b> the value the <b>stronger</b> the relationship</li></ul>              |
| <b><math>XED &gt; 0</math></b><br><b>Substitutes</b>         | <ul style="list-style-type: none"><li>▪ The <b>positive</b> value indicates the two goods are substitutes</li><li>▪ The <b>higher</b> the value, the <b>stronger</b> the relationship</li></ul>             |
| <b><math>XED = 0</math></b><br><b>Unrelated goods</b>        | <ul style="list-style-type: none"><li>▪ A value of <b>zero</b> indicates that there is <b>no relationship</b> between the two goods.</li><li>▪ The closer to zero, the weaker the relationship is</li></ul> |

### Substitutes (XED is positive)

- Substitute goods are **alternatives** that serve similar purposes. When the **price of one rises**, consumers tend to **switch to the other**, increasing its demand
- A **positive XED** indicates this relationship

Examples:



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- If the price of **Coca-Cola** increases, demand for **Pepsi** may rise as a comparable alternative
- A rise in the price of **Spotify Premium** could lead some consumers to choose **Apple Music** or **YouTube Music** instead
- In a school cafeteria, if **burgers** become more expensive, students might opt for **pizza**



### Examiner Tips and Tricks

Consumer behaviour assumes rational decision-making. Your personal preferences may override price sensitivity. For instance, a student who only enjoys burgers may not switch to pizza even if prices change

## Complements (XED is negative)

- Complementary goods are typically **consumed together**
- When the **price of one increases, demand for the other tends to fall**. A **negative XED** reflects this joint relationship
- These goods rely on each other to deliver full value, so pricing decisions in one area can directly affect demand in another

### Examples:

- An increase in the price of **cinema tickets** might reduce demand for **popcorn**, as fewer people attend
- If **mobile data plans** become more expensive, usage of **streaming apps** may decline
- A price hike on **gaming consoles** could lead to lower sales of **video games** and **controllers**

## Unrelated goods (XED = zero)

- Unrelated goods have no meaningful connection. A change in the price of one does not influence demand for the other

### Examples:

- A rise in the price of **beef** has no impact on a **vegan's** demand for **tofu**
- If **football boots** become more expensive, it won't affect how many **paintbrushes** art students buy
- An increase in the price of **concert tickets** will not influence demand for **mathematics revision guides**

## Using XED in decision-making

- **Knowledge of XED** is important to firms as they seek to **maximise their revenue**



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- It can help them **adjust pricing strategies** for substitute and complementary products
- It can help them understand the likely impact of **competitors' pricing strategies** on their sales
- Businesses often monitor how changes in competitors' prices affect demand for their own products

## 1. Substitutes: Positive XED

- When two products are substitutes, a price increase in one tends to boost demand for the other
  - For example, if the price of **Netflix** rises, more consumers might switch to **Disney+** or **Amazon Prime Video**. In such cases, firms are highly interdependent, and a competitor's price cut could significantly reduce their own sales
- If a company discovers that its product has an **XED of +1.5** with a rival's offering, **it means that a 10% drop in the competitor's price could lead to a 15% fall in demand** for its own product
  - The higher the XED, the stronger the substitution effect

## 2. Complements: Negative XED

- Complementary goods are jointly demanded, so a price increase in one can reduce demand for the other
  - For instance, if the price of **mobile phones** goes up, fewer people may buy **phone cases** or **screen protectors**. Similarly, if **gym memberships** become more expensive, demand for **fitness clothing** might decline
- Companies often aim to sell bundles of complementary products—like **gaming consoles** with **exclusive games** – and use XED to design pricing strategies that maximize overall revenue

## Strategic pricing and consumer Behaviour

- Families might spend more at **theme parks** when entry tickets are discounted, even if the price elasticity of the tickets themselves is low
- Lower ticket prices encourage spending on **snacks, souvenirs, or rides**, which are products with strong complementary relationships
- In such cases, firms may need to rethink pricing across their entire product range rather than focusing on one item alone



### Examiner Tips and Tricks

You can evaluate XED by explaining why calculating accurate elasticity values is complex

If a drop in demand for **electric scooters** follows a price increase, was this due to cost or changing consumer preferences, weather conditions, or new regulations?



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