

### 2.5 Elasticity of demand (includes HL only sub-topics)



# **Learning objectives**

2.5 Elasticity of demand (includes HL only sub-topics)	Depth	Diagrams & calculations		
Concept of elasticity	AO1 AO4	Diagram: relatively elastic and inelastic demand		
Price elasticity of demand (PED)	AO2	Diagram: constant PED – perfectly elastic, perfectly inelastic and		
• PED = $\frac{\% \Delta Q d}{\% \Delta P}$	AO4	unitary PED along a demand curve.		
<ul> <li>Degrees of PED – theoretical range of values for PED</li> <li>Changing PED along a straight-line downward sloping demand curve (HL only)</li> </ul>		Diagram (HL only): PED along the straight-line demand curve		
		Diagram: showing changes in		
		revenue as a result of price changes when demand is price		
<ul> <li>Determinants of PED – number and closeness of substitutes,</li> </ul>		elastic and price inelastic		
degree of necessity, proportion of income spent on the good, time		Calculation: PED, change in price,		
Relationship between PED and total revenue		from data provided		



# **Learning objectives**

2.5 Elasticity of demand (includes HL only sub-topics)	Depth	Diagrams & calculations
<ul><li>Price elasticity of demand (PED)</li><li>Importance of PED for firms and government decision-making</li></ul>	AO3	
<ul> <li>Reasons why the PED for primary commodities is generally lower than the PED for manufactured products (HL only)</li> </ul>	AO2	~
Income elasticity of demand (YED) • VED $= \frac{\% \Delta Q d}{M}$	AO2 AO4	Diagram: showing income elastic, income inelastic and inferior goods on an Engel curve
<ul> <li>Income elastic demand (services and luxury goods) and income inelastic demand (necessities)</li> </ul>		Calculation: YED, change in income, quantity demanded from data provided

# **Learning objectives**

2.5 Elasticity of demand (includes HL only sub-topics)	Depth	Diagrams & calculations
Income elasticity of demand (YED)	AO2	
Significance of sign	AO4	
<ul> <li>Positive YED (normal goods) and negative YED (inferior</li> </ul>		
goods)		
<ul> <li>Less than one (necessities) and greater than one (services</li> </ul>		
and luxury goods)		
<ul> <li>Importance of YED (HL only):</li> </ul>	AO3	
for firms		
<ul> <li>in explaining changes in the sectoral structure of the</li> </ul>		
economy.		





### **Real world example**

How might consumers respond when the price of insulin increases significantly?





### Introduction

**Elasticity** in economics, refers to the responsiveness of a variable as a result of a change in another variable. **Elasticity of Demand** measures the responsiveness of the quantity demanded in a market as a result of factors such as price or income.



Demand is price **inelastic** when a change in price leads to a proportionally lower change in quantity demanded. In this case, consumers are less responsive to changes in price.



What are some examples of goods with price **inelastic** demand?



Demand is price **elastic** when a change in price leads to a proportionally greater change in quantity demanded. In this case, consumers are highly responsive to changes in price.



What are some examples of goods with price **inelastic** demand?



# **Price Elasticity of Demand (PED)**

**Price elasticity of demand (PED)** measures the responsiveness of quantity demanded to a change in price and is calculated using the formula:

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

PED quantifies the law of demand, hence it is always negative. The negative sign may be omitted as the value is always negative, due to the law of demand, and only the absolute value of the PED is of concern.



Demand is **price elastic** if a change in price leads to a <u>proportionally greater</u> change in quantity demanded. Meanwhile, demand is **price inelastic** if a change in price leads to a **proportionally lesser** change in quantity demanded.

Therefore, mathematically, demand is price elastic if:

|PED| > 1 or PED < -1

It follows that demand is price inelastic if:

|PED| < 1 or PED > -1



# Over to you...

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 94
- Paper 1 Exam Practice Question 7.1
- [10 marks]





### PED along the demand curve (HL only)

The percentage change in quantity demanded is greater at higher price levels, despite the gradient of the demand curve being the same.

- As price approaches zero (point B), the percentage change in price (denominator of PED formula), approaches infinity. Overall, the PED value approaches zero.
- As quantity demanded approaches zero (point A), the percentage change in quantity demanded (numerator of the PED formula) approaches infinity. Hence, the PED value approaches infinity.





## PED along the demand curve (HL only)

At the midpoint of the demand curve (point M), the percentage change in quantity demanded (numerator) is equal to the percentage change in price (denominator). Hence, PED is equal to 1.

Thus, it follows that:

- At prices above the midpoint, demand is price elastic.
- At prices below the midpoint, demand is price inelastic.



# Over to you...

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 97
- Paper 1 Exam Practice Question 7.6
- [10 marks]





# **Relationship between PED and Total Revenue (TR)**

The **marginal revenue** curve is the gradient function of the total revenue curve and represents the revenue gained for every additional unit sold.



The MR curve is always twice as steep as the linear demand curve.

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Total revenue is maximized where PED = 1 and MR = 0.
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### **Theoretical range of values for PED**

While the PED varies in downward-sloping linear demand curves, there are three special cases where the PED value stays constant:





# **Determinants of PED**

The determinants of PED can be remembered through the following mnemonic **HINTS**:

- H Habits
- Income
- N Necessity
- T Time
- S Substitutes





### **Real world example – research activity**

Article: Drug Goes From \$13.50 a Tablet to \$750, Overnight

With reference to the determinants of PED and information from the article, examine the likely elasticity of the drug "Daraprim".



### **Real world example – research activity**

The drug is not habit-forming and "many patients use the drug for far less than a year".

Despite the 5,500% increase, the cost of Daraprim accounts for a small proportion of median income.

The degree of necessity for Daraprim is very high as it is a life-saving form of medical intervention.

- To protect against "a life-threatening parasitic infection", the time period involved is very short and consumers do not have time to look for alternatives.
- S

There are no close substitutes and "Daraprim's distribution is now tightly controlled, making it harder for generic companies to get the samples they need for the required testing."



# Over to you...

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 95
- Paper 2 and 3 Exam Practice Question 7.2
- [4 marks]





# Impact of PED on the decision-making of firms

#### **Revenue maximization**

- If PED < 1 i.e. price inelastic, firms can increase prices to increase total revenue
- If PED > 1 i.e. price elastic, firms can reduce prices to increase total revenue
- Firms can adjust prices to the point where
   PED = 1 to maximize total revenue







### **Real world example**

Discuss the arguments for and arguments against firms aiming to maximize revenues for drugs such as Daraprim.



# Impact of PED on the decision-making of firms



Why are tickets cheaper for students at movie theatres?

#### **Price discrimination**

- Firms face different market segments with differing PED
- Students have generally have lower incomes in comparison to adults.
- Firms can charge higher prices for price inelastic segments (i.e. adults) and lower prices for price elastic segments (i.e. students) to try and maximize revenue.



# Impact of PED on the decision-making of firms



Why are airline tickets more expensive

during Christmas and summer periods?

### **Dynamic pricing**

- Many families with children looking to travel may be restricted to the school holidays. These
  consumers have few alternative periods where they can travel therefore are less price sensitive
  to higher prices.
- Airlines can increase prices during these holiday periods where consumers are less price sensitive while reducing prices during off-seasons where consumers are more price sensitive.



### Impact of PED on the decision-making of governments

#### **Taxation polices**

• When demand is **price elastic**, an increase in price will lead to a proportionally greater fall in quantity demanded. Governments can tax products with price elastic demand to effectively discourage its consumption without a significant tax burden on consumers.

• When demand is **price inelastic**, an increase in price will lead to a proportionally lesser fall in quantity demanded. Hence, governments can tax price inelastic products, such as cigarettes and alcohol, as a source of government revenue.



### Impact of business sector on the PED of a good/service

The main determinants of PED are _	habits	, income	necessity	time	_, and
substitutes					

**Primary commodities** are agricultural products produced in the primary sector of the economy.

The PED for primary commodities is relatively **low**:

- Primary commodities are essential for manufacturing
- Primary commodities account for a small proportion of (national) income
- There are fewer substitutes for primary commodities.



### Impact of business sector on the PED of a good/service

The main determinants of PED are _	habits	, income ,	necessity	time	_, and
substitutes					

Manufactured products are goods produced in the secondary sector of the economy.

The PED for manufactured goods is relatively **high**:

- There is a lower degree of necessity
- Secondary goods account for a higher proportion of income
- There are many more substitutes.



# Over to you...

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 95
- Paper 2 and 3 Exam Practice Question 7.3
- [10 + 4 marks]
- Page 97
- Paper 1 Exam Practice Question 7.4
- [10 marks]





### **Income Elasticity of Demand (YED)**

**Income elasticity of demand (YED)** measures the responsiveness of quantity demanded to a change in real income of consumers. It is calculated using the formula:

$$YED = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in real income}} = \frac{\% \Delta Q d}{\% \Delta Y}$$

The mathematical value for YED can either be positive or negative depending on the type of good and therefore, the sign (+) (-) of the YED value is significant and should be indicated.





### **Normal goods**

**Normal goods** refer to goods with a positive PED value, where demand increases as consumer increases. Normal goods can be separated into necessities and luxury goods.



### **Interpretations of YED – Necessities**

**Necessities** are goods and services used to satisfy basic needs where consumer demand does not increase or decrease significantly with changes in income. Hence:

0 < YED < 1

Examples may include:

- Toothpaste
- Toilet paper
- Staple foods, e.g. rice, bread, and pasta.





# **Interpretations of YED – Luxury goods**

**Luxury goods** are goods and services used to satisfy wants and indulgences, where demand changes proportionately greater to the change in income. Hence:

YED > 1

Examples may include:

- Mechanical watches
- Designer clothing
- Sports cars.





### **Interpretations of YED – Inferior goods**

**Inferior goods** are goods and services with more expensive and higher quality substitutes. As incomes rise, demand for inferior goods fall as consumers are more willing and able to purchase better alternatives. Hence a negative relationship:

#### YED < 0

Similarly, as incomes fall, demand for inferior goods rise as consumers are less able to afford the better alternatives and resort to the cheaper substitute. Examples include microwave meals, instant noodles, secondhand clothes, and canned foods.



# Over to you...

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 108
- Paper 1 Exam Practice Question 8.1
- [10 marks]





### **Engel Curve**

**The Engel Curve** is a visual representation of the relationship between income and quantity demanded.

Take the bread market for example:

- At low-income levels of Y1, bread may be considered as a normal or luxury good.
- As incomes rises to Y2, quantity demanded increases at a proportionally higher rate from Q1 to Q2 as a significant portion of income is spent on food to satisfy basic needs.



- An incomes continue to increase to Y3, the increase in quantity demanded from Q2 to Q3 may slow as there is a limited amount of bread consumers would purchase to satisfy their needs.
- Bread may turn from a luxury good for very lowincome consumers (Y1) to a necessity for middle income consumers (Y3).



As incomes continue to increase to Y4 for very high-income consumers, the quantity demanded for bread may begin to decrease to Q4 as better and more expensive alternative food options may be sought after, such as fresh organic vegetables. Thus, bread may eventually become an inferior good as real incomes continue to rise.



#### **Engel Curve for Bread**

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### Impact of YED on the decision-making of economic agents

YED can be used for estimating the impact of changes in the business cycle, hence income, on different markets:

- **Necessities** are less affected by business cycle fluctuations; demand stay relatively constant.
- **Luxury goods** are subject to the highest volatility in demand; proportionately stronger demand during economic booms and proportionately weaker demand in recessions.
- **Inferior goods** are counter-cyclical. For example, supermarkets may increase offerings for canned foods and microwaved meals during a recession while reducing these during a boom and increasing inventory for exotic foods such as imported fruits and fresh produce.



Suppose you are the manager of a department store responsible for selecting the range of goods and services to stock. Suggest a product portfolio for the following two scenarios:

- a) An economic boom where average consumer incomes are rising.
- b) An economic recession where average consumer incomes are falling.

Produce your work on a poster or as a presentation.



### Impact of YED on the decision-making of economic agents

YED can be used for understanding sectoral changes as a result of higher incomes. As incomes rise:

- The primary sector providing primary commodities
   (0 < YED < 1) grows at a slower rate.</li>
- The secondary sector providing manufactured products (YED > 1) grows at a faster rate.
- The tertiary sector providing services (YED > 1) likely grows at an even faster rates.





# Over to you...

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 109
- Paper 1 Exam Practice Question 8.3
- [10 marks]







### Test your knowledge on this unit: <u>Kahoot!</u>

