PRICE MECHANISM AND ITS APPLICATIONS (PART 2)

1. **Elasticities and its Applications**

   1.1 Price Elasticity
   1.1.1   Price Elasticity of Demand (PED)
     1.1.1.1 Definition of PED
     1.1.1.2 Interpretation of PED
     1.1.1.3 Determinants of PED
     1.1.1.4 Application of PED
   1.1.2   Price Elasticity of Supply (PES)
     1.1.2.1 Definition of PES
     1.1.2.2 Interpretation of PES
     1.1.2.3 Determinants of PES
     1.1.2.4 Application of PES

   1.2 Cross Elasticity of Demand (CED)
   1.2.1   Definition of CED
   1.2.2   Interpretation of CED
   1.2.3   Determinants of CED
   1.2.4   Application of CED

   1.3 Income Elasticity of Demand (YED)
   1.3.1   Definition of YED
   1.3.2   Interpretation of YED
   1.3.3   Determinants of YED
   1.3.4   Application of YED

   1.4 Limitations in the application of elasticity concepts

2. **Government intervention in Markets**

   2.1 Taxes
   2.1.1   Indirect taxes
   2.1.2   Direct taxes
   2.2 Subsidies
   2.2.1   Indirect subsidies
   2.2.2   Direct subsidies
   2.3 Price controls
   2.3.1   Minimum price
   2.3.2   Maximum price
   2.4 Quantity controls
   2.4.1   Quotas

3. **Labour Market**

   3.1 Labour Demand
   3.2 Labour Supply
   3.3 Wage Determination
   3.4 Wage Differentials

Appendix:

1. Price Elasticity of Demand along a Linear Demand Curve
2. Exercises on Applications of PED and PES
3. Exercises on Incidence of Indirect Tax/Subsidy
4. Application of Price Mechanism to Different Market Arenas
5. Determinants of PED and PES of Labour
6. Wage Determination in Singapore

References:

1. Sloman, J. (2013). Economics (6th Edition). England: Pearson.
2. Mankiw, G. N., Quah, E., & Wilson, P. (2013). Principles of Economics - An Asian Edition (2nd Edition). Singapore: Cengage Learning.
3. Frank, R. H., & Bernanke, B. S. (2012). Principles of Economics (5th Edition). McGraw Hill.
4. Case, K. E., Fair, R. C., & Oster, S. (2013). Principles of Economics (11th Edition). Pearson Education.

Lecture Objectives:

After this series of lectures and tutorials, students should be able to:

- Define the concepts of price elasticity of demand/supply (PED/PES), cross elasticity of demand (CED) and income elasticity of demand (YED).
- Explain the determinants of PED, PES, CED and YED.
- Analyse the extent of changes in price and quantity in response to shifts in demand or supply, using PES or PED respectively.
- Analyse the change in revenue in response to changes in price using PED.
- Analyse the direction and extent of shift in demand in response to changes in price of related goods or income, using CED or YED respectively.
- Explain the relevance of PED, CED and YED to market outcomes, governments and firms.
- Define the types of government intervention such as taxes (direct vs indirect), subsidies (direct vs indirect), price controls and quantity controls.
- Distinguish between impact and incidence of tax/subsidy, and explain the distribution of the incidence between buyers and sellers using PED and PES.
- Distinguish between price floor/ceiling, explain the resultant surplus/shortage, and analyse the size of the surplus/shortage using PED and PES.
- Explain the mechanism of the different government interventions in the market, and the effects on price, quantity, welfare and government revenue/expenditure.
- Explain the determinants of labour demand and labour supply, and how they interact to determine wage and employment.

1. Elasticities and Its Applications

'Elasticity' is a measure of **degree of responsiveness** of a variable (e.g. quantity demanded or quantity supplied) to a change in one of its determinants, ceteris paribus. 'Elastic' is used to describe a high level of responsiveness, which means that the determinant has a strong influence on the variable. Conversely, 'inelastic' suggests that the variable is not easily influenced by changes in the determinant.

1.1 Price Elasticity

Price elasticity measures the degree of responsiveness of a variable to a change in the **price determinant**, ceteris paribus. Since price is a determinant of both demand and supply, the price elasticity of demand and the price elasticity of supply are two types of price elasticity measures.

1.1.1 Price Elasticity of Demand (PED)

1.1.1.1 Definition of PED

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

Its mathematical formula is:

$$PED = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price of gd itself}}$$

$$= \frac{\Delta Qd}{Qd_0} \div \frac{\Delta P}{P_0}$$

$$= \frac{\Delta Qd}{\Delta P} \times \frac{P_0}{Qd_0}$$

1.1.1.2 Interpretation of PED

- Sign

The sign of PED is normally negative because of the inverse relationship between price and quantity demanded. According to the Law of Demand, if there is an increase in price (positive change in the denominator), there will be a fall in quantity demanded (negative change in the numerator). Thus, as long as the Law of Demand holds, PED will be a negative value. Quite often, the negative sign is dropped in the presentation of PED values, with only the absolute values presented. Students must bear in mind the Law of Demand when interpreting such data.

- Magnitude

The magnitude of absolute PED ranges between 0 to infinity, and indicates the sensitivity of consumers to price changes. The larger the magnitude of the coefficient the greater the sensitivity of consumers to price changes.
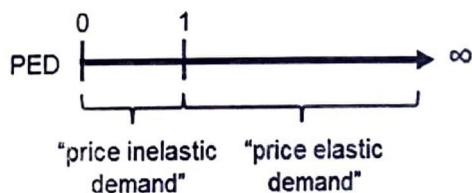
Key Point:
The sign of PED is always negative, and is thus dropped during presentation by convention. The magnitude of PED is determined by the degree of responsiveness of quantity demanded of a good/service when its price changes.

Think:
Will you expect the sign of Price Elasticity of Supply (PES) to be always negative as well? Why? What will the definition of PES be?

The value of PED[1] is < 1 when demand is price inelastic. This means that consumers are less sensitive to price changes, thus, quantity demanded is less responsive to changes in prices, ceteris paribus. A change in price will therefore lead to a less than proportionate change in quantity demanded, ceteris paribus.
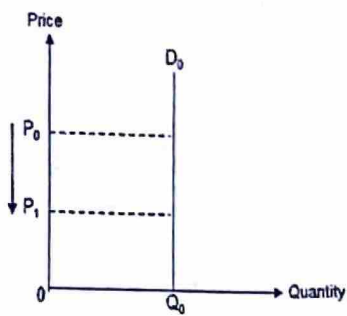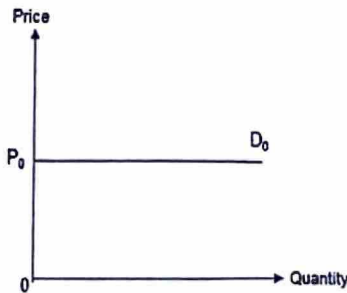
Conversely, the value of PED is > 1 when demand is price elastic. A change in price will therefore lead to a more than proportionate change in quantity demanded, ceteris paribus.

Coefficient	Interpretation	Diagram
$\|PED\| < 1$	**Price inelastic demand** A fall (rise) in price from P_0 to P_1 will lead to a less than proportionate increase (decrease) in quantity demanded from Q_0 to Q_1, ceteris paribus. For example, if PED=0.5, a 1% decrease in price will cause a 0.5% increase in quantity demanded.	
$\|PED\| > 1$	**Price elastic demand** A fall (rise) in price from P_0 to P_1 will lead to a more than proportionate increase (decrease) in quantity demanded from Q_0 to Q_1, ceteris paribus. For example, if PED=3, a 1% decrease in price will cause a 3% increase in quantity demanded.	
$\|PED\| = 1$	**Unitary (unit) price elastic demand** A fall (rise) in price from P_0 to P_1 will lead to an equal proportionate increase(decrease) in quantity demanded from Q_0 to Q_1, ceteris paribus. Since PED = 1, a 1% decrease in price will cause a 1% increase in quantity demanded. The demand curve would be a hyperbola.	

Note:
Analysis is usually focused on
(I) PED < 1
(ii) PED > 1

[1] The absolute value of the PED (i.e. ignoring the negative sign).

$\lvert PED \rvert = 0$	**Perfectly price inelastic demand** Price changes have no effect on quantity demanded, which remains fixed at Q_0. Since PED = 0, a 1% decrease in price will cause a 0% increase in quantity demanded. This occurs when consumers are willing and able to pay any price for a given quantity of the good.		**Think:** Can you think of any real world examples of perfectly price-inelastic and price-elastic demand?
$\lvert PED \rvert = \infty$	**Perfectly price elastic demand** Price changes have huge effects on quantity demanded. • At exactly P_0, consumers will buy any quantity of the good. • Any fall in price will lead to an infinite increase in quantity demanded. • Any rise in price will cause quantity demanded to fall to zero.		

A straight line/linear demand curve has different elasticity at each point on it. Refer to Appendix 1 for details on the point elasticity along a linear demand curve.

1.1.1.3 Determinants of PED

Some goods have demand that is price inelastic, while others have demand that are price elastic. Since consumers of different goods have different sensitivity to price changes, the PED varies from one good to another. PED is dependent on determinants, which include:

• Number and closeness of substitutes

The **number and closeness of substitutes** that are available is one of the most important determinants of PED. Consumers more likely to consider alternatives to the good when the price of the good changes if there is a large number of close substitutes available. If the price of a good rises, consumers can readily switch to other substitutes, and this will cause a more than proportionate fall in quantity demanded for the good. Hence, the greater the number of close substitutes available for a good, the more price elastic is the demand.

The availability of substitutes is, in turn, dependent on **the way the market is defined.** Narrowly defined markets tend to have more price elastic demand compared to broadly defined markets, because it is easier to find close substitutes for narrowly defined goods. "Apple" is narrowly defined compared to "fruit", which is a broader definition. There are many different types of fruit that can substitute apples, such as oranges or grapefruit, thus the demand for apples would be price elastic. However, there are not many other types of food that can substitute fruit in general, thus the demand for fruits will be more price inelastic as compared to the demand for apples.

- Proportion of income spent on the good

The higher the **proportion of income spent on a good**, the more people will be forced to reduce their consumption when price increases; hence the more price elastic their demand will be. This is because small increases in the price will take up more of the consumer's available income. For example, demand for cars is relatively price elastic as the price of a car constitutes a significant proportion of a household's income. A given % increase in the price of car will significantly affect a household's ability and decision to purchase a car. For instance, if price of a car is $100,000, a 10% rise in price would mean a hefty extra expenditure of $10,000, discouraging the new purchase of a car.

In contrast, some goods such as sugar, candles and salt take up only a very small percentage of the income of most households. For example, if a packet of salt is $2, the same 10% rise in price has much less impact on the household's decision to purchase the good.

- Habituality of consumption

Demand tends to be price inelastic if the good is bought **habitually**. Quantity demanded is not very responsive to changes in price as consumers continue to buy a similar amount of the good regardless of price changes. For example, demand for rice in many Asian societies is relatively price inelastic compared to other Western countries because rice is a staple food in Asian societies.

A special case of habitual consumption relates to a consumer's **addiction** to a particular good. The greater the degree of addiction to a substance (alcohol, cigarettes and drugs), the more price inelastic is the demand. A price increase, ceteris paribus, will not bring forth a significant reduction in quantity demanded if one is severely addicted.

- Time horizon

When the price of a good rises, consumers will take time to respond to the price change, adjust their consumption pattern and find alternatives. Time is required to develop or discover substitutes. The longer the time period, the more likely consumers can switch to other substitutes and hence demand will be more price elastic.

For example, if there is an increase in the price oil for heating purposes, ceteris paribus, consumers can do little to switch to other sources of heating in a short period of time. Thus, demand for heating oil tends to be price inelastic over short time periods. As time goes by, they are able to switch to other heating sources, such as gas, or they can install better insulation, and demand for heating oil becomes more price elastic.

1.1.1.4 Application of PED

<u>Applying PED to explain changes in price and quantity</u>

The concept of PED is most relevant **when there are price changes**, typically resulting from changes in supply in a perfectly competitive market. **When supply changes, the extent to which price and quantity changes depends on PED.**

For instance, the supply of agricultural products may fall due to a drought. In Figure 1, supply falls from S_0 to S_1. This fall in supply creates a shortage of agricultural products. However, because agriculture has few substitutes and is habitually consumed for food, their demand is price inelastic – which means that quantity demanded does not respond readily to price changes. Because quantity demanded does not change easily, a higher price is needed in order to eliminate the persistent shortage. Price rises to P_1. Since $|PED| < 1$, a rise in price will cause a less than proportionate fall in quantity demanded from Q_0 to Q_1, and the final equilibrium quantity would be at Q_1.
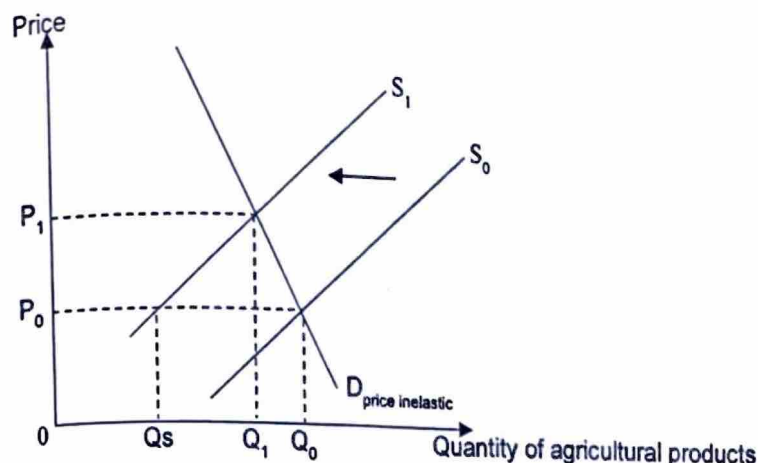
Figure 1: Market for Agricultural products

In contrast, the demand for luxury cruise services is price elastic because it is not habitually consumed and also takes up a relatively larger proportion of consumers' incomes. If the supply of luxury cruise services fall, a shortage is also created — but is more readily eliminated because consumers are responsive to changes in price and reduce quantity demanded significantly. Thus, prices do not have to rise by much in order to reduce the quantity demanded. In Figure 2, when supply falls from S_0 to S_1, price rises to P_1. Since $|PED| > 1$, a rise in price of P0 to P1 will cause a more than proportionate fall in quantity demanded from Q0 to Q_1.
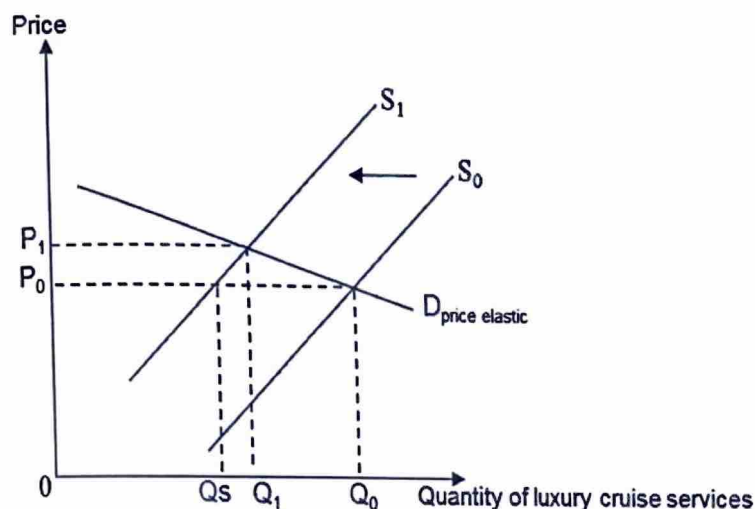
Figure 2: Market for luxury cruise services

Thus, when supply changes, the extent to which price and quantity changes depends on PED. In Figure 3, a demand that is price inelastic is compared against one that is price elastic, in the context of a rise in supply. For a given increase in supply from S_0 to S_1, price will fall and quantity demanded will rise. If the demand is price inelastic, the decrease in price to P_1 will be greater than if the demand was price elastic (P_2). Also, the increase in quantity demanded to Q_1 will be smaller than if the demand was price elastic (Q_2).
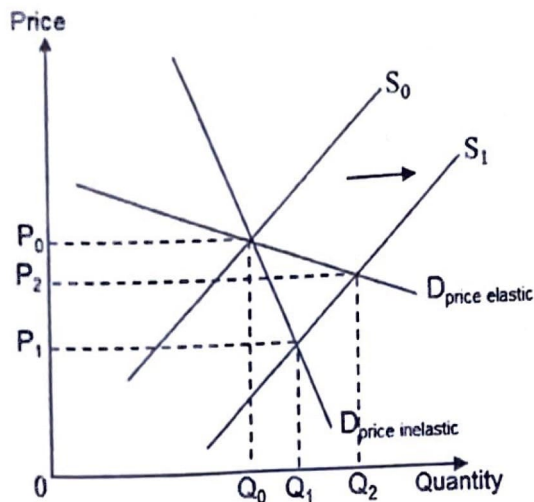
Figure 3: Comparing the effect of rise in supply between PED<1 and PED>1

A table can be drawn to summarize how differences in PED will affect the impact of changes in supply on price and quantity:

		|PED| < 1	|PED| > 1
Increase in supply	↓P	Large ↓P	Small ↓P
	↑Q	Less than proportionate ↑Q	More than proportionate ↑Q
Decrease in supply	↑P	Large ↑P	Small ↑P
	↓Q	Less than proportionate ↓Q	More than proportionate ↓Q

> **Think:**
> Is PED useful in analysing the effects of demand changes?

Applying PED to explain changes in total revenue/total expenditure

Other than price and quantity, **PED is also relevant for examining the impact of changes in price on the total revenue earned by firms**, which would be equivalent to the total expenditure of consumers. The total revenue[2] (total expenditure), TR = price per unit x no. of units sold = P x Q.

> **Key Point:**
> PED is used to analyse changes in revenue arising from price changes.

Due to the Law of Demand, quantity demanded always decreases when price rises and vice versa. To determine the impact on total revenue, a comparison between the extent to which quantity demanded decreases/increases and the extent to which price rises/falls is necessary.

With reference to the Figure 4, when demand is price inelastic, a rise in price from P_0 to P_1(due to a fall in supply) will lead to a less than proportionate decrease in quantity demanded from Q_0 to Q_1. The gain in revenue due to the rise in price (Area P_0P_1ab) is more than the loss in revenue resulting from the decrease in quantity demanded (Area Q_0Q_1bc). The final revenue (Area $0P_1aQ_1$) is greater than initial revenue (Area $0P_0cQ_0$). Hence, when demand for the firm's product is price inelastic, a rise in price will lead to an increase in total revenue.

---

[2]Note that total revenue is different from profits. Profits = Total Revenue – Total Cost.
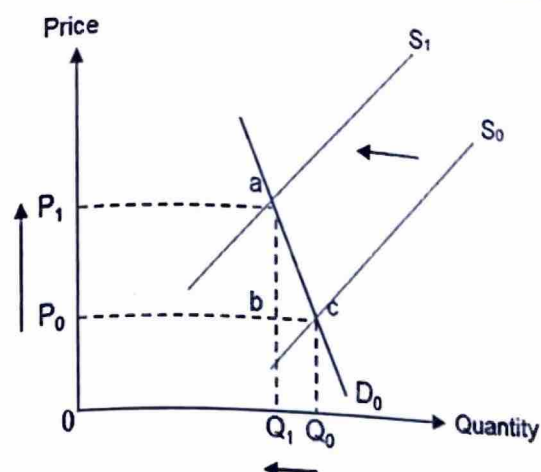
Figure 4: Examining how a rise in price affects total revenue when PED<1

With reference to the Figure 5, when demand is price elastic, a rise in price (due to a fall in supply) from P_0 to P_1 will lead to a more than proportionate decrease in quantity demanded from Q_0 to Q_1. The gain in revenue due to the rise in price (Area P_0P_1ab) is less than the loss in revenue resulting from the decrease in quantity demanded (Area Q_0Q_1bc). The final revenue (Area $0P_1aQ_1$) is smaller than initial revenue (Area $0P_0cQ_0$). Hence, when demand for the firm's product is price elastic, a rise in price will lead to an overall fall in total revenue.
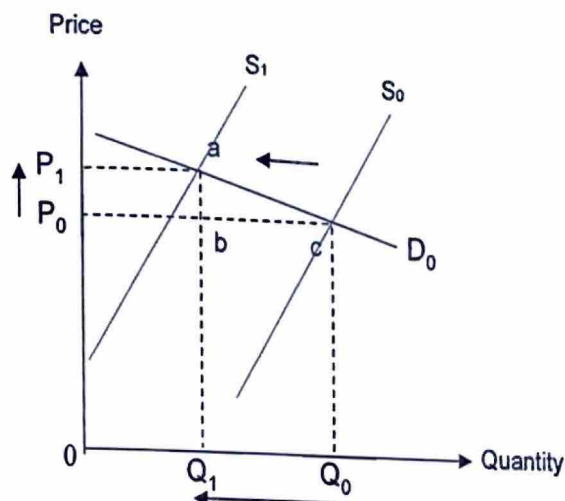
Figure 5: Examining how a fall in price affects total revenue when PED>1

A table can be drawn to summarize how differences in PED will affect the impact of changes in price on total revenue:

	|PED| < 1		|PED| > 1	
Rise in price	↑P	Total revenue increases	Small ↑P	Total revenue decreases
	Less than proportionate ↓Q		More than proportionate ↓Q	
Fall in price	↓P	Total revenue decreases	Small ↓P	Total revenue increases
	Less than proportionate ↑Q		More than proportionate ↑Q	

Applying PED to explain the behaviour of firms

In view of how PED affects total revenue, firms can make a few beneficial decisions:

- First, they can raise prices for goods with price inelastic demand and lower prices for goods with price elastic demand[3]. This will help them increase their revenue. The effects on their profits, where Profits = Total Revenue − Total Cost, is uncertain.

  As quantity increases, TC will rise. If the rise in TR > the rise in TC, then profits will increase. In the event that the rise in TR < the rise in TC, overall profits will fall. In the case of a good whose PED < 1, it is possible for profits to rise since the rise in TR due to an increase in price > fall in TR due to a fall in quantity demanded, leading to an overall rise in TR. This, coupled with the fact that TC is likely to fall due to a fall in quantity, means profits is likely to rise.

  In the case of a good for which PED > 1, it is more likely that profits will increase with a fall in price. This is because, the loss in TR due to a fall in price < rise in TR due to an increase in quantity demanded, leading to an overall rise in TR. However, TC is also likely to rise with an increase in quantity, hence, if the rise in TR < rise in TC, it is likely that overall profits will fall instead. Thus, in reality, it is rather uncommon for firms to lower prices as a means to raise profits.

- Next, in the long run, firms can focus on business strategies to make the demand of its products more price inelastic. In the short run, there tends to be a lack of close substitutes to a firm's product. For example, when Nike releases a new model of shoes into the market, there tends to be little or no close substitutes to the model in the short run. However, in the long run, competitors such as Adidas will have time to replicate and produce products that are deemed as close substitutes. As such, the demand for Nike's new sports shoe will be relatively more price elastic in the long run, and it will have to reduce its prices to increase its revenue.

- In order for firms to able to keep their prices high, they need to engage in business strategies to reduce the substitutability of their products to keep its demand price inelastic in the long run. For example, firms may choose to advertise to create perceived differences in products, reducing their substitutability. Research and development around product development will also improve the quality of the product and reduce its substitutability. This will allow them to raise prices, which would lead to a less than proportionate decrease in quantity demanded. Total revenue rises as a result.

The use of PED by firms in making pricing/output and business strategy, will be further covered under 'Firms and Decisions'.

1.1.2 Price Elasticity of Supply (PES)

1.1.2.1 Definition of PES

Price elasticity of supply (PES) is a measure of the degree of responsiveness of the **quantity supplied** of a good to a **change in its price**, ceteris paribus.

Its mathematical formula is:

$$PES = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price of good itself}}$$

---

[3] A firm in a perfectly competitive market has no control over price and is a price-taker – prices are solely determined by market demand and supply forces. However, if this assumption is relaxed (i.e. firms are not in perfect competition), then a firm can set its own prices and is a price-setter. This will be covered under the topic Firms and Decisions.

$$= \frac{\Delta Qs}{Qs_0} \div \frac{\Delta P}{P_0}$$

$$= \frac{\Delta Qs}{\Delta P} \times \frac{P_0}{Q_0}$$

1.1.2.2 Interpretation of PES

- Sign

The sign of PES is normally positive because of the direct relationship between price and quantity supplied. According to the Law of Supply, if there is an increase price (positive change in the denominator), there will be a rise in quantity supplied (positive change in the numerator). Thus, as long as the Law of Supply holds, PES will be a positive value.

- Magnitude

The magnitude of PES ranges between 0 to infinity, and indicates the sensitivity of producers to price changes. The larger the magnitude of the coefficient the greater the sensitivity of producers to price changes.
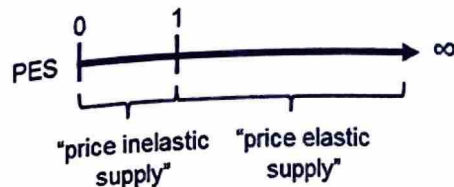
The value of PES is between 0 to 1 when supply is price inelastic. This means that producers are less sensitive to price changes, thus, quantity supplied is less responsive to changes in prices, ceteris paribus. A change in price will therefore lead to a less than proportionate change in quantity supplied ceteris paribus.

Conversely, the value of PES is more than 1 when supply is price elastic. A change in price will therefore lead to a more than proportionate change in quantity supplied.
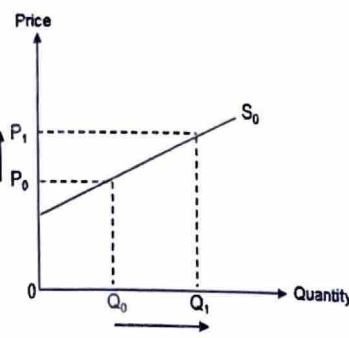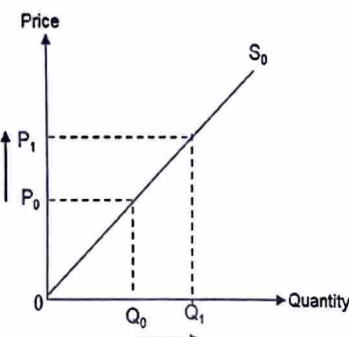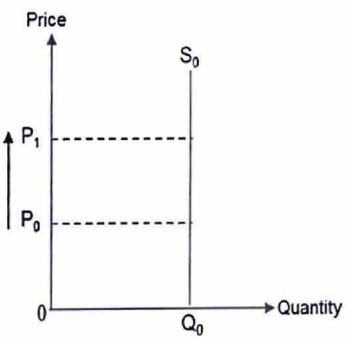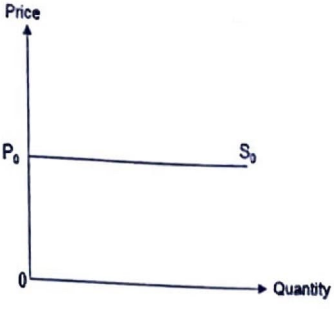
Coefficient	Interpretation	Diagram
$|PES| < 1$	**Price inelastic supply** A rise (fall) in price from P_0 to P_1 will lead to a less than proportionate increase (decrease) in quantity supplied from Q_0 to Q_1, ceteris paribus. For example, if PES=0.5, a 1% increase in price will cause a 0.5% increase in quantity supplied. All straight line curves passing through the positive x-axis show price inelastic supply.	

$\lvert PES\rvert > 1$	**Price elastic supply** A rise (fall) in price from P_0 to P_1 will lead to a more than proportionate increase (decrease) in quantity supplied from Q_0 to Q_1, ceteris paribus. For example, if PES=3, a 1% increase in price will cause a 3% increase in quantity supplied. All straight line curves passing through the positive y-axis show price elastic supply.	
$\lvert PES\rvert = 1$	**Unitary (unit) price elastic supply** A rise (fall) in price from P_0 to P_1 will lead to a proportionate increase(decrease) in quantity supplied from Q_0 to Q_1, ceteris paribus. Since PES = 1, a 1% increase in price will cause a 1% increase in quantity supplied. All straight line supply curves from the origin show unitary price elastic supply.	
$\lvert PES\rvert = 0$	**Perfectly price inelastic supply** Price changes have no effect on quantity supplied, which remains fixed at Q_0. Since PES = 0, a 1% increase in price will cause a 0% increase in quantity supplied. This occurs when producers are willing and able to sell only a given quantity of the good, regardless of the price offered.	

	Perfectly price elastic supply Price changes have huge effects on quantity supplied. • At exactly P_0, producers can produce any quantity of the good. • Any rise in price will lead to an infinite increase in quantity supplied. • Any fall in price will cause quantity supplied to fall to zero.	
$\|PES\| = \infty$		

1.1.2.3 Determinants of PES

Some goods have supply that is price inelastic, while others have supply that are price elastic. Since producers of different goods have different sensitivity to price changes, the PES varies from one good to another. PES is dependent on determinants, which include:

• Level of stock or inventory

The **level of stock** affects how readily producers can respond to price changes. When price rises and incentivises producers to increase the quantity supplied of their products, firms with more stock and inventory can respond quickly by drawing down on their stock to offer their products for sale. Thus, quantity supplied is responsive to price changes and supply is said to be price elastic when there is high level of stock.

The availability of stock, in turn, **depends on the ease of storing the stock.** For instance, perishable food items such as vegetables may not be easy to store while processed products such as canned food has longer shelf-life and are easier to keep as stock. If the price of canned food increases, the firm can increase quantity supplied readily by drawing out these stocks. However, if the price of perishable food increases, firms cannot readily increase quantity supplied as if they do not have stocks and will need a long time to produce the food. Thus, when the product is perishable and is not easily stocked up, its supply will be price inelastic.

• Availability of spare capacity

If firms hold sufficient **stock of raw materials** and at the same time it has the **physical spare capacity** (e.g. factories or equipment that are idle), production can be increased readily in response to price increases. If the firm's capacity is saturated, it will be more difficult to increase production in response to a price rise. Hence, the greater the availability of factors of production and spare capacity, the more price elastic the supply.

• Mobility of factors of production

Factor mobility refers to the **ease and speed at which factors of production can move from one industry to another.** The more easily and quickly resources can be shifted from one industry to another, the greater the degree of responsiveness of quantity supplied to changes in price, and hence the higher the value of PES. For instance, if a printing machine can be easily switched from printing newspaper to magazines, then the supply of newspapers and magazines would be more price elastic since firms can readily channel more factors of production from one market to another market in response to changes in price.

• Time horizon

When the price of a good changes, producers will take time to respond and adjust their production pattern. Time is required to for firms to increase or decrease their quantity supplied. The longer the time period, the more price elastic the market supply will be.

In the momentary period, supply is **perfectly price inelastic** because it is impossible for the firm to change output immediately in response to changes in price. This is because all factors of production are fixed. Supply is restricted to the quantities available in the market at that point in time. For example, a rise in price due to a sudden surge in demand for fish on a particular day will hardly influence the quantity of fish supplied that day. The fishmonger will not be able to increase the amount available for sale on the spot.

The **short run** is a period where production is restricted by at least one factor of production[4]. In the short run, supply is relatively price inelastic because the quantity supplied can be increased to some extent in response to an increase in price as some inputs can be varied whilst others remain fixed. For example, the producer of manufactured goods can increase quantity supplied by placing orders for more raw materials and getting workers to work overtime[5]. However, there would be a limit to the increase in quantity supplied because the producer is unable to expand the number of industrial machines or increase the size of his factory floor space at that point in time[6].

The **long run** is a period where **all factors of production are variable**[7]. Because all factors of production are variable as there is sufficient time for firms to acquire inputs to expand production and for new firms to enter the industry, the quantity supplied in the market becomes more responsive. Supply becomes highly price elastic in the long run.

- Length of production period

Often, the time taken to produce goods/services and the processes involved in production affects the speed at which producers can respond to price changes. The longer the production period, the more time producers take to respond to price changes by altering their quantity supplied accordingly.

For instance, compared to most manufactured goods, in **agriculture**, time is required to increase output in response to rise in prices of goods due to the **long gestation periods** of crops. The supply of agricultural goods is thus fairly price inelastic in comparison to that of manufactured consumer goods that can be produced in factories in a comparatively shorter time period. Likewise, the PES for **housing and property** is likely to be less than 1, as it takes a long time, years in fact, to complete a single building project. Hence, a rise in price leads to a less than proportionate increase in quantity supplied.

1.1.2.4 Application of PES

Applying PES to explain changes in price and quantity

The concept of PES is most relevant **when there are price changes** resulting from changes in demand in a perfectly competitive market. **When demand changes, the extent to which price and quantity changes depends on PES.**

Key Point:
PES is used to analyse the effects of demand changes.

For instance, the demand for crude oil, a primary commodity, may rise due to a rising population with greater energy needs. In Figure 6, demand rises from D_0 to D_1. This rise in demand creates a shortage of oil. However, because crude oil takes a long time to be produced (time needed for mining) and spare capacity is limited (depletion of oil source), their supply is price inelastic – which means that quantity supplied cannot change easily. Because quantity supplied does not rise easily, a much higher price is needed in order to

---

[4] This is the technical definition of the short run period, and will be covered in detail under the topic *Firms and Decisions*.

[5] Raw materials and labour are typically considered variable factors.

[6] Industrial machines and land space (for factory) are typically considered fixed factors.

[7] Again, this is the technical definition of the long run period, and will be covered in detail under the topic *Firms and Decisions*.

eliminate the persistent shortage. Price rises to P_1. Since $|PES| < 1$, a rise in price from P_0 to P_1 will cause a less than proportionate rise in quantity supplied from Q_0 to Q_1.
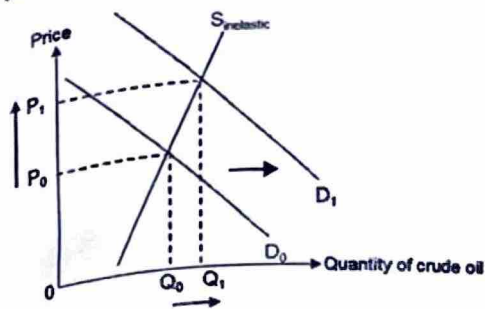
Figure 6: Market for crude oil

In contrast, the supply of electronics is price elastic because it is easily produced and stocked up as inventory. If the demand for electronics rises, a shortage is also created – but is more readily eliminated because producers are can easily increase quantity supplied in response. Thus, prices do not have to rise by much in order to eliminate the shortage. In Figure 7, when demand rises from D_0 to D_1, price rises to P_1. Since $|PES| > 1$, a rise in price from P_0 to P_1 will cause a more than proportionate rise in quantity supplied from Q_0 to Q_1.
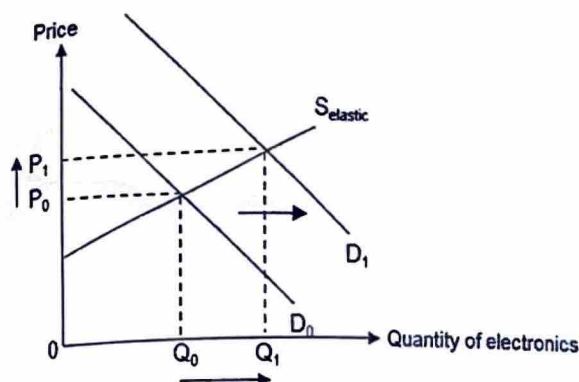
Figure 7: Market for electronics

Thus, when demand changes, the extent to which price and quantity changes depends on PES. In Figure 8, a supply that is price inelastic is compared against one that is price elastic, in the context of a rise in demand. For a given increase in demand from D_0 to D_1, both price and quantity will rise. If the supply is price inelastic, the increase in price to P_1 will be greater than if the supply was price elastic (P_2). Also, the increase in quantity to Q_1 will be smaller than if the supply was price elastic (Q_2).
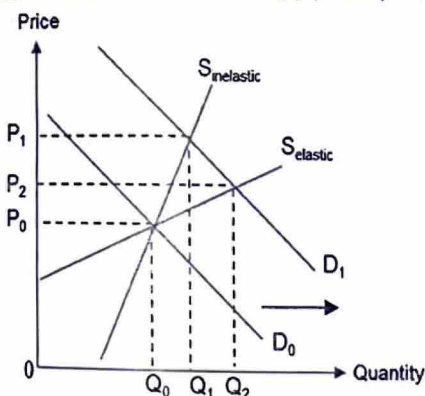
Figure 8: Comparing the effect of rise in demand between PES<1 and PES>1

A table can be drawn to summarize how differences in PES will affect the impact of changes in demand on price and quantity:

		|PES| < 1	|PES| > 1
Increase in demand	↑P	Large ↑P	Small ↑P
	↑Q	Less than proportionate ↑Q	More than proportionate ↑Q
Decrease in demand	↓P	Large ↓P	Small ↓P
	↓Q	Less than proportionate ↓Q	More than proportionate ↓Q

1.2 Cross Elasticity of Demand (CED)

1.2.1 Definition of CED

Cross elasticity of demand (CED) is a measure of the degree of responsiveness of the **quantity demanded** of a good to a **change in the price of another good**, ceteris paribus.

Its mathematical formula is:

$$CED \text{ (of gd A wrt } \Delta \text{ price of gd B)} = \frac{\% \, \Delta \text{ in quantity demanded of good A}}{\% \, \Delta \text{ in price of good B}}$$

$$= \frac{\Delta Q_A}{Q_A} \div \frac{\Delta P_B}{P_B}$$

$$= \frac{\Delta Q_A}{\Delta P_B} \times \frac{P_B}{Q_A}$$

1.2.2 Interpretation of CED

- Sign

The sign of CED between two goods may be **positive or negative**, depending on how they are related. Because the sign indicates the relationship between the goods, it is important and cannot be ignored (unlike price elasticities). CED can also be zero if the two goods are not related at all.

If CED is positive (CED > 0), the two goods are substitutes. An increase in the price of good B will lead to an increase in the demand for good A. For example, Pepsi substitutes Coca-Cola. If the price of Coca-Cola increases, the quantity demanded of Coca-Cola falls, and the demand for Pepsi will increase as consumers switch from Coca-Cola to Pepsi. Therefore, a rise in price of a substitute causes an increase in demand for the good.

If CED is negative (CED < 0), the two goods are complements. An increase in the price of good B will lead to a fall in the demand for good A. For example, tennis balls complement tennis rackets. If the price of tennis rackets increases, the quantity demanded for tennis rackets falls, and the demand for tennis balls will decrease as consumers buy less of both tennis rackets and tennis balls. Therefore, a rise in price of a complement causes a decrease in demand for the good.

If CED is zero (CED = 0), then the two goods are unrelated. An increase in the price of good B has no effect on the demand for good A.

- **Magnitude**

The magnitude of CED indicates the **strength of the relationship** between the two goods – be it substitutes or complements. The closer the substitutes/complements, the greater the magnitude will be.
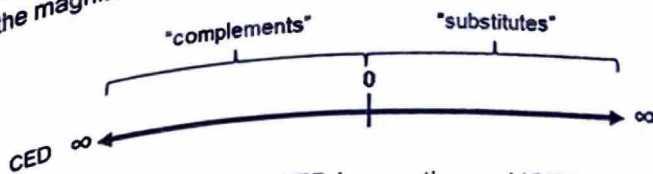
For complements, if the CED is negative and |CED| is large, then the two goods are close complements. Good A has a negative cross elastic demand with respect to the price of good B. This means that consumers of good A are very sensitive to changes in price of good B. A rise (fall) in price of good B will therefore lead to a more than proportionate decrease (increase) in the demand for good A.
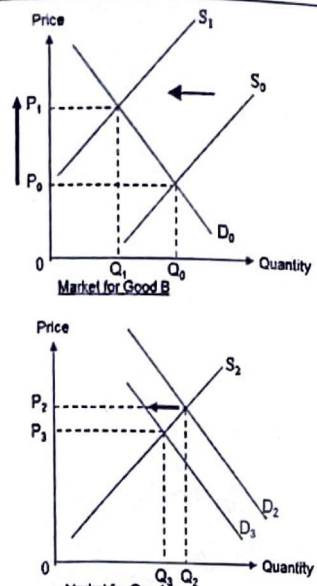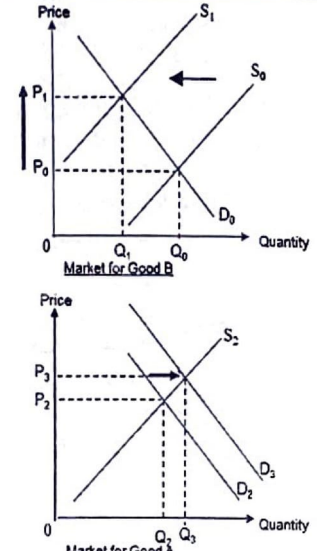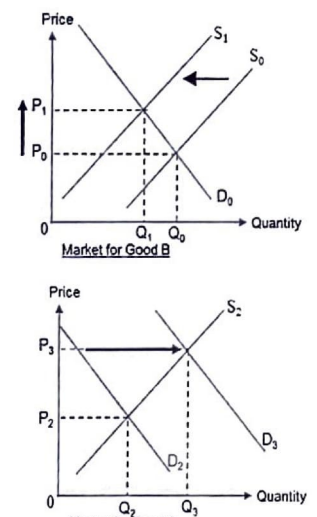
Also for complements, if the CED is negative and |CED| is small, then the two goods are not close complements. Good A has a negative cross inelastic demand with respect to the price of good B. This means that consumers of good A are not sensitive to changes in price of good B. A rise (fall) in price of good B will therefore lead to a less than proportionate decrease (increase) in demand for good A.

For substitutes, if the CED is positive and |CED| is small, then the two goods are not close substitutes. Good A has a positive cross inelastic demand with respect to the price of good B. This means that consumers of good A are not sensitive to changes in price of good B. A rise (fall) in price of good B will therefore lead to a less than proportionate increase (decrease) in the demand for good A.

Also for substitutes, if the CED is positive and |CED| is large, then the two goods are close substitutes. Good A has a positive cross elastic demand with respect to the price of good B. This means that consumers of good A are very sensitive to changes in price of good B. A rise (fall) in price of good B will therefore lead to a more than proportionate increase (decrease) in demand for good A.

Coefficient	Interpretation	Diagram
CED< 0 & |CED| is large	**Strong complements** A rise (fall) in price of Good B from P_0 to P_1 will lead to a more than proportionate decrease (increase) in demand for Good A from D_2 to D_3, ceteris paribus. There is a large leftward shift in the demand curve for good A.	

CED <0 & |CED| is small	**Weak complements** A rise (fall) in price of Good B from P_0 to P_1 will lead to a less than proportionate decrease (increase) in demand for Good A from D_2 to D_3, ceteris paribus. There is a small leftward shift in the demand curve for good A.	
CED >0 & |CED| is small	**Weak substitutes** A rise (fall) in price of Good B from P_0 to P_1 will lead to a less than proportionate increase (decrease) in demand for Good A from D_2 to D_3, ceteris paribus. There is a small rightward shift in the demand curve for good A.	
CED > 0 & |CED| is large	**Strong substitutes** A rise (fall) in price of Good B from P_0 to P_1 will lead to a more than proportionate increase (decrease) in demand for Good A from D_2 to D_3, ceteris paribus. There is a large rightward shift in the demand curve for good A.	

1.2.3 Determinants of CED

The determinants of CED between two goods are 1) **the relationship between the two goods** that determines the sign of the coefficient; 2) the **closeness of the relationship** between the two goods that determines the magnitude of the absolute value of the CED. These have been covered in 1.2.2.

1.2.4 Application of CED

Applying CED to explain changes in demand

The concept of CED is relevant when there are price changes of a related good. When the price of a related good changes, the change in the demand for the good (in terms of direction and extent) depends on CED. Knowledge of the CED allows one to explain and predict changes in the market.

Applying CED to explain the behaviour of firms

Firms use CED in their business decision-making as it provides information on the extent to which the demand for their products will be affected when faced with a change in the price of substitute or complementary products.

For instance, a firm may have a product that has a high positive CED in relation to his rival's product. Since the CED between the two products is >1, they are close substitutes. When the price of the rival's product falls, there will be a large decrease in demand for the firm's product. This fall in demand reduces the firm's revenue, and consequently profits. Thus, the firm will have to respond to changes in the price of the rival's product with price and non-price strategies.

- **Price strategy**: If the price of the substitute falls, the firm has to respond by lowering the price of his good to prevent a huge loss of existing and potential customers.
- **Non-price strategy**: Also, the firm could try to reduce the CED between its product and its substitutes by making its good less substitutable. This reduces the effect of its rival's pricing policies on the demand for the firm's product. This can be achieved through advertising or adding different features to his product. Examples of such strategies include providing better customer services and introducing membership schemes. These increase consumers' brand loyalty and also make the firm's product less substitutable and affected by the pricing policy of its rivals.

On the other hand, a firm may have a product that has a high negative CED in relation to another firm's products. Since the CED between the two products is < -1, they are close complements. When the price of this other firm's product falls, there would be a large increase in demand for the firm's product. This rise in demand increases the firm's revenue and consequently profits. The firm would make non-price decisions to leverage on this.

- **Non-price strategies:**
  - If the price of the complement falls, the firm can plan for the increase the production of the good, or release inventory/stocks.
  - Businesses producing strongly complementary goods can collaborate. A firm offering two goods that are complementary can package them together for sale or display them in the same area so that customers can buy both of them at the same time. For instance, salad vegetables are found in the same section as salad sauce in supermarkets, and airline tickets are often packaged with hotel accommodation deals.

1.3 Income Elasticity of Demand (YED)

1.3.1 Definition of YED

Income elasticity of demand (YED) is a measure of the degree of responsiveness of the **quantity demanded** of a good to a **change in consumers' income**, ceteris paribus.

Its mathematical formula is:

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

$$= \frac{\Delta Q}{Q_0} \div \frac{\Delta Y}{Y_0} \quad = \frac{\Delta Q}{\Delta Y} \times \frac{Y_0}{Q_0}$$

1.3.2 Interpretation of YED

- Sign

The sign of YED a good may be positive or negative, depending on whether the good is an inferior or a normal good (including necessity and luxury)[8]. Because the sign indicates the type of good, it is important and cannot be ignored (unlike price elasticities). YED can also be zero if the demand for the good is independent of changes in income.

If YED is positive (YED > 0), the good is a normal good. The demand for the good is positively related to income, and an increase in income increases the demand for the good. Most goods are normal goods. When incomes rises, the purchasing power of consumers increases, thus they increase their demand for normal goods, be it necessity or luxury goods.

If YED is negative (YED < 0), the good is an inferior good. The demand for the good is negatively related to income, and an increase in income decreases the demand for the good. Inferior goods are often replaced by better quality and more expensive goods as consumers become more affluent. For example, potatoes may be considered inferior goods because they are a cheap and less nutritious food source that consumers turn to when they lack money to buy better food. However, when income rises, consumers can replace potatoes in their diet with better quality food like meats. Thus, they decrease their demand for potatoes.

- Magnitude

The magnitude of YED indicates the **strength of the relationship between income and the demand for the good.** The stronger income is as a deciding factor when consumers make decisions about purchasing the good, the greater the magnitude will be.

---
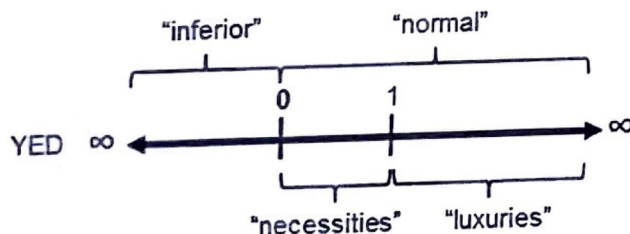
[8]The terms *inferior goods, necessities,* and *luxuries* are not value judgments, but are simply a means to classify goods based on their economic behaviour. In fact, inferior goods do not necessarily have to be cheap goods – as long as they are quickly replaced by other more expensive and better quality goods when consumers experience rising affluence, they can be classified inferior.

For normal goods, if the YED is positive and less than one (0<YED<1), then the good is classified as a **necessity**. The demand for the good is positively income inelastic. This means that income is not a strong determinant of consumers' demand. A rise (fall) in income will therefore lead to a less than proportionate increase (decrease) in demand, ceteris paribus.

If the YED is positive and more than one (YED>1), then the good is classified as a **luxury**. The demand for the good is positively income elastic. This means that income is a strong determinant of consumers' demand. A rise (fall) in income will therefore lead to a more than proportionate increase (decrease) in demand, ceteris paribus.

Coefficient	Interpretation	Diagram
YED<0	**Inferior good** A rise (fall) in income will lead to a decrease (increase) in demand from D_0 to D_1, ceteris paribus. For example, if YED= - 0.5, a 1% increase in income will cause a 0.5% decrease in quantity demanded, ceteris paribus. (The magnitude of the shift depends on the magnitude of the absolute value of the YED)	
YED > 0 & $|YED| < 1$	**Normal good - Necessity** A rise (fall) in income will lead to a less than proportionate increase (decrease) in demand from D_0 to D_1, ceteris paribus. For example, if YED=0.5, a 1% increase in income will cause a 0.5% increase in quantity demanded, ceteris paribus. There is a small rightward shift in the demand curve for good A.	
YED > 0 & $|YED| > 1$	**Normal good - Luxury** A rise (fall) in income will lead to a more than proportionate increase (decrease) in demand from D_0 to D_1, ceteris paribus. For example, if YED=3, a 1% increase in income will cause a 3% increase in quantity demanded, ceteris paribus. There is a large rightward shift in the demand curve for good A.	

1.3.3 Determinants of YED

Some goods have demand that is positively related to income, while others have demand that are negatively related to income. The **nature of the good** in terms of whether it is an inferior good or a normal good will determine whether the YED has a positive or negative value. Inferior goods have negative YED values while normal goods have positive YED values. These have been covered in 1.3.2.

- **Degree of necessity**

Normal goods may have YED > 1 or 0 < YED < 1. |YED| is dependent on the **degree of necessity of the good**. The more basic an item is in the consumption pattern of households, the lower is its YED tends to be. Empirical studies find that basic food items such as bread and rice usually have positive income elasticities less than one. When income rises, demand for basic food items increase but to a less than proportionate extent. In contrast, luxury foods such as high quality cuts of meat and prepared food usually have positive income elasticities more than one. When income rises, demand for luxury food items increase and to a more than proportionate extent.

The degree of necessity, in turn, depends on **the level of income of the consumer base**. For instance, when the income levels of the consumers are low, only the basic necessities have a high degree of necessity, while many other items are considered luxuries. However, when the level of income of the consumer base has risen and the lifestyles of the consumers change, less goods and services will be considered luxurious. For example, a meal at a mid-range restaurant might be a luxury good in a market where consumers have low incomes (e.g. third world countries). However, a meal at a mid-range restaurant might be a daily occurrence when the consumers in the market are affluent, and would therefore be a necessity. Similarly, a hawker meal may be considered an inferior good in a market where consumers are affluent, although in a market where consumers have low income levels it would likely be a normal good.

YED values for the same good can vary depending on the income levels. Empirical studies show that countries at **different stages of economic development** have widely different income elasticities for the same products. This is because a necessity in a developed country may be a luxury product in a developing country. For example, items such as meat and bus journeys have lower income elasticity of demand in developed countries but they can be expected to have higher income elasticity of demand in developing countries. The former deems them to be more of necessities whilst they are treated as luxury goods in the latter.

1.3.4 Application of YED

Applying YED to explain changes in demand

The concept of YED is relevant when there are changes in income. When income changes, the change in the demand for the good (in terms of direction and extent) depends on YED. Knowledge of the YED allows economists to explain and predict changes in the market. These have been covered in 1.3.1.

Applying YED to explain behaviours of firms

Also, **firms use YED in their business decision-making** as it provides information on the extent to which the demand of their products will be affected when income levels change. This allows firms to plan future output accordingly.

> **Key Point:**
> YED is used by firms and governments in their decision-making.

- When the economy experiences economic growth and households' incomes are rising, the firm would stand to benefit from a higher demand of normal goods, more so for luxuries than for necessities. This rise in demand increases total revenue for firms, which will increase their profits (assuming costs remain unchanged). Firms may use the following non-price business strategies.

  o Firms may strategize by channeling more resources into developing better quality and highly desirable products with YED > 1. For instance, travel agencies could offer more luxurious holiday packages instead of budget travel packages. Companies could develop smartphones with more luxurious features such as titanium plating or leather clad bodies such as the brands Vertu and Lamborghini Mobile.

- Conversely, when the economy is going through a recession and households incomes fall, the demand for normal goods will fall while the demand for inferior goods will rise. Firms can adopt the following non-price strategies.

  o Firms may channel resources from the production of luxury goods to the production of necessities to minimize the fall in demand for their products. For instance, designer fashion retailers may produce more designer make-up instead of designer handbags and shoes, since make-up is more necessary and affordable for their consumers as compared to handbags and shoes.

  o Firms may also promote their inferior goods to capture a larger share of the rising demand for inferior goods in the market.[9]

Firms can also use differences in YED across different consumer bases to segment markets and produce the appropriate range of products to suit the consumer bases.

- In the event of an economic boom where household incomes rise, the application of YED in order to raise TR would require a large supermarket to stock up on goods with YED > 1 i.e. luxurious items, at all its outlets nation-wide.
  However, since YED values attached to a given good may vary across different income levels as previously mentioned, the supermarket may strategize by carrying different goods with different degrees of luxury, in its outlets located in an upper-class income district from that of its outlets located in the heartlands. For example, the supermarket would carry more of premium items such as caviar, foie gras at its outlets in the higher income districts while it stocks up more of luxurious items such as organic foods such as organic kale and free-range eggs in its outlets in the heartlands.

- International firms would also market their products differently in different countries because the YED of the same product may differ widely across countries in different stages of development. For instance, canned food may be a necessity (normal good) in a developing country but may be considered an inferior good (since it is replaced with more expensive, fresher alternatives) in a developed country where there is higher income per capita. In times of economic growth where consumers' incomes rise, supermarkets offering fresh vegetables and poultry for example, would increase their capacity to sell in developing countries as demand for fresh food is expected to increase more than proportionately. On the other hand, provision shops will reduce their capacity to sell canned food in developed countries.

Applying YED to explain government decisions

YED is a relevant consideration in the **decision-making of the government**. When there is economic growth or recession that affects the incomes of the consumers, knowledge of YED of different goods and services helps the government predict changes in demand patterns. This allows the government to make better decisions with regards to planning their expenditure and implementation of policies.

---

[9] It is unlikely, though, for firms to market their normal goods as inferior goods as such brand-bashing will have negative consequences in the long-run when incomes increase.

- Planning

For example, in the housing market. YED can be used to predict changes in demand for the various types of public housing. In view of rising income levels, there may be a more than proportionate increase in demand for more luxurious Design, Build and Sell Scheme (DBSS) and Executive Condominiums (EC) as opposed to 3-Room flats. HDB can make better decisions on the number of each type of public housing to build. As such, knowledge of the sign and value of YED can help the HDB better allocate scarce resources when deciding whether to build more DBSS and EC or 3-room flats.

- Policies

Elasticity concepts are also used in macroeconomic policy decision making. This will be taught in *Macroeconomic Aims and Issues* and *Macroeconomic Policies* in Year 6.

1.4 Limitations in the application of elasticity concepts

While the theory behind the concepts of various elasticities is very useful for explanation and prediction of market outcomes, in reality, there are limitations to the use of elasticity concepts. These include:

- Computation issues

When applying the concepts of elasticity, economists may face difficulties in calculating or determining exact elasticity values. For instance, to calculate the PED, data on the changes in price and quantity demanded is required. Firstly, the accuracy of the data depends on the method collection. Because a large amount of data is collected, errors may be made that undermines the accuracy of the data. In that case, the value of the PED would be inaccurate and the use of it may not be reliable.

> **Question:**
> Are these computational concerns still a challenge today? Why or why not?

- Issues with prediction

The values of elasticities are calculated based on past data, so they may not be relevant for current use. The more outdated the data, the less relevant it becomes. Given the nature of our present dynamic economy, such estimates may become outdated quickly. Thus, the values of the elasticities may not be very useful for prediction of future market changes.

- Cost concerns

While elasticity concepts can be used to predict revenue changes, they do not give any information about costs. Strategies implemented to increase total revenue might increase also increase costs. For example, if PED > 1, a firm should decrease prices, which would increase quantity demanded more than proportionately, and hence, increase total revenue. However, this increase in quantity demanded might also increase costs, if so, given that profit = total revenue − total cost, profit might not increase.

- Ceteris paribus assumption

The statement "all other things being equal" is a very strict assumption that cannot hold in reality. The results that are calculated from the static analysis are inaccurate because in the dynamic real world, the effects of changes occur and interact together instead of separately. For example, in the application of PED concept, only the price of the good is allowed to change while other factors of demand are assumed to remain constant. This is not true in the real world where other factors of demand such as income levels, population size and tastes and preferences are always changing. As such, the ceteris paribus assumption is unrealistic in the prediction of effects of price changes on market equilibrium level of outputs. This is because the accuracy of the value of |PED| may be compromised when estimation is made based on these simplifying assumptions. The same problem is experienced in the use of PES, CED and YED.

Sectional Summary

- Elasticity is a measure of the degree of responsiveness of quantity demanded/supplied to a change in one of its determinants (e.g. price, price of related goods, income).
- If quantity demanded/supplied changes proportionately more than the determinant, the magnitude of the elasticity is greater than 1. The demand/supply is described as "elastic".
- If quantity demanded/supplied changes proportionately lesser than the determinant, the magnitude of the elasticity is lesser than 1. The demand/supply is described as "inelastic".
- Price elasticity of demand (PED) is a measure of the degree of responsiveness of the quantity demanded of a good to a change in its price, ceteris paribus. Its determinants include number and closeness of substitutes, proportion of income spent on the good, habituality of consumption, and the time horizon.
- PED is relevant when analysing the extent to which price and quantity changes in response to a shift in supply.
- PED is also relevant when analysing the change in revenue in response to a change in price.
- Price elasticity of supply (PES) is a measure of the degree of responsiveness of the quantity supplied of a good to a change in its price, ceteris paribus. Its determinants include level of stocks or inventories, availability of spare capacity, mobility of factors of production, and the time horizon.
- PES is relevant when analysing the extent to which price and quantity changes in response to a shift in demand.
- Cross elasticity of demand (CED) is a measure of the degree of responsiveness of the quantity demanded of a good to a change in the price of another good, ceteris paribus. Its determinants include the relationship between the two goods (sign) and the closeness of the relationship (magnitude).
- CED is relevant when analysing the direction and extent of the shift in demand in response to a change in the price of a related good.
- Income elasticity of demand (YED) is a measure of the degree of responsiveness of the quantity demanded of a good to a change in consumers' income, ceteris paribus. Its determinants include whether the good is inferior or normal (sign) and if it is a normal good, the degree of necessity (magnitude).
- YED is relevant when analysing the direction and extent of the shift in demand in response to a change in income.
- Firms use information on PED, CED and YED to make decisions that can help them respond to market changes, and reduce loss of profits or increase profits.
- The limitations of using elasticity values include computation issues, issues with prediction, cost concerns and the unrealistic ceteris paribus assumption.

2. Government intervention in Markets

Governments may intervene in markets for various reasons. The rationale for government intervention will be covered under the topic *Market Failure and Government Intervention*. The theory of price mechanism, including the various elasticity concepts, can be applied to explain how policies work and examine the impact of government intervention on market outcomes.

2.1 Taxes

Taxes are compulsory payments to the government and are used by governments for various reasons – including to raise government revenue and to resolve market failure[10].

---

[10]Market failure is defined as the failure of the free market to achieve allocative efficiency, resulting in over-allocation or under-allocation of resources relative to the socially efficient level and/or to achieve equity, because of problems like income inequality. This will be covered under the topic *Market Failure and Government Intervention*.

Taxes may be indirectly imposed or directly imposed, depending on whether the tax is imposed on expenditure on goods and services, or on income and wealth.

When analysing the effects of a tax, economists look at the incidence of taxation.

- **The incidence of the tax** is the distribution of the burden of tax between sellers and buyers. The incidence of the tax might fall more on the seller or the buyer, depending on how either is ultimately is affected by the taxation.

2.1.1 Indirect taxes

Indirect taxes are **taxes on goods and services** and are **paid to the tax authorities indirectly by the suppliers of the goods and services.** Indirect taxes can come in the form of specific tax or ad valorem tax. A **specific tax** is an indirect tax of a fixed sum per unit sold (e.g. excise duty on alcohol which is $60 per litre; excise duty on unleaded motor spirit which is $6.40 per 10 litres), while an **ad valorem tax** is an indirect tax of a certain percentage of the price of the good (e.g. Goods and Services Tax which is 7%).

An indirect tax falls on producers. Indirect taxes increase the cost of production for firms and leads to a leftward shift of the supply curve. Specifically, when an **indirect tax is imposed, supply decreases, represented by an upward shift of the supply curve by the amount of the tax.**

Type of indirect tax	Shift In Supply	Diagram
Specific tax	A specific tax will shift the supply curve vertically upwards by the amount of the tax ($t). Since the amount of tax is the same at all prices, supply curve shifts **parallel** upwards (or shifts leftwards) from S_0 to S_1.	 Market for Alcohol
Ad valorem tax	An ad valorem tax, or a percentage tax, is a tax pegged at a certain percentage of the price of the good. As price rises, the amount of tax to be paid rises. This results in an upward (or leftward) **pivotal** shift of the supply curve from S_0 to S_1.	 Market for Restaurant Food

Note: If the details of a tax are not specified, it can be assumed as an indirect tax for the purpose of analysing its effects.

Assuming that the government imposes an indirect tax (e.g. a specific tax of $3), the supply curve shifts from S_0 to S_1 in Figure 9. The imposition of an indirect tax will causes price to rise from P_0 to P_1 and quantity to fall from Q_0 to Q_1. Government will receive tax revenue of Area P_sP_1ac.
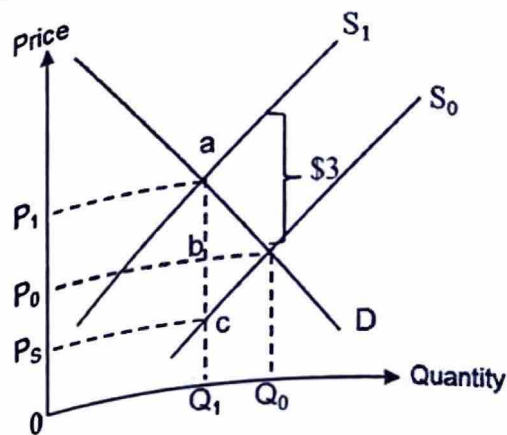
Figure 9: Effect of indirect tax (specific) on market for good

However, note that the equilibrium price does not rise by the full amount of the per unit tax (i.e. the difference between P_1 and P_0 is less than $3).

- Consumers who used to pay P_0 now pay P_1 since the equilibrium price has changed after the fall in supply.
- Producers who used to receive P_0 now receive P_1 from consumers, but pay taxes of $3 to the government. Therefore, they only receive P_s after the taxation.
- Government will receive tax revenue of Area P_sP_1ac (tax per unit * Q_1).

The consumers' incidence of the tax is reflected by the extent of the increase in price from P_0 to P_1. The producers' incidence of the tax is the amount by which the rise in price is insufficient to cover the tax, which is P_0 to P_s. In this way, the incidence of tax is shared between producers and consumers.

The incidence of taxation between consumers and producers will depend on both the price elasticity of demand and the price elasticity of supply of the good, more specifically the relative values of PED to PES.

Note:
You will not be required to analyse the incidence of taxes and subsidies in exams.

Relative price elasticities	Market Outcomes	Diagram
PED < PES	With the tax (=ac), the supply curve shifts left from S_0 to S_1. Price increases from P_0 to P_1 while quantity decreases from Q_0 to Q_1. Consumers bear tax incidence of P_0P_1, and the total burden on consumers is Area P_0P_1ab. Producers bear tax incidence of P_0P_s, and the total burden on producers is Area P_sP_0bc. Government receives tax revenue of Area P_sP_1ac in total. When demand is relatively more price inelastic than supply, buyers are less responsive to changes in the price of the good compared to sellers. Therefore, buyers bear a greater burden of the tax.	

PED > PES	With the tax (=ac), the supply curve shifts left from S_0 to S_1. Price increases from P_0 to P_1 while quantity decreases from Q_0 to Q_1. Consumers bear tax incidence of P_0P_1, and the total burden on consumers is Area P_0P_1ab. Producers bear tax incidence of P_0P_s, and the total burden on producers is Area P_sP_0bc. Government receives tax revenue of Area P_sP_1ac in total. When demand is relatively more price elastic than supply, buyers are more responsive to changes in the price of the good compared to sellers. Therefore, sellers bear a greater burden of the tax.	

Think:
Can you name an example of a market where PED > PES?

Indirect taxes also have impacts on the welfare of consumers, producers and society as a whole. If market failure exists, government intervention in the form of taxation may serve to resolve the market failure to achieve efficiency in the market. (This will be taught in the topic of *Market Failure*.) However, in the absence of market failure, indirect taxation may result in welfare loss and inefficiency in the market instead.

Assuming the free market output level Q_0 in Figure 10 is initially allocatively efficient. When government imposes an indirect tax that causes the supply curve to shift from S_0 to S_1, there will be changes in consumer surplus, producer surplus, government revenue and society's welfare.
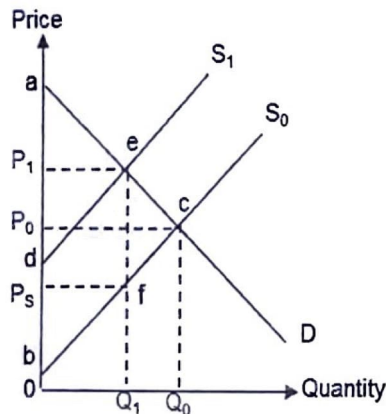
Figure 10: Effect of indirect tax (specific) on welfare

- Consumer surplus falls from Area P_0ac to Area P_1ae. There is a loss of consumer surplus of Area P_0P_1ec.
- Producer surplus falls from Area P_0bc to Area P_sfb. There is a loss of producer surplus of Area P_0P_sfc.
- Government revenue of Area P_sP_1ef is gained. The government revenue contributes to society's welfare.
- Change in society's welfare = change in consumer surplus (-Area P_0P_1ec) + change in producer surplus (-Area P_0P_sfc) + change in government revenue

(P_sP_1ef). There is an overall loss of society's welfare of Area ecf. This constitutes a deadweight loss to society.

Consumer surplus fell because even though the maximum price consumers are willing and able to pay did not change, with the imposition of the sales tax, the actual price consumers have to pay has increased from P_0 to P_1. In addition, consumers also see a fall in the quantity of good consumed from Q_0 to Q_1.

Producer surplus also fell because with the imposition of the sales tax, the actual price producers retained (after the government has collected the tax) from the selling of the goods fell from P_0 to P_s and the quantity of good sold fell from Q_0 to Q_1.

Part of the losses in consumer and producer surpluses were **transferred to the government as an increase in tax revenue** received. However, the losses were not fully recouped by the government, and **society experiences a deadweight loss** because of the indirect taxation (assuming no market failure initially). Deadweight loss represents welfare benefits that are lost to society because resources are not allocated efficiently. In this case the loss of benefits due to under-allocation of scarce resources to the production of the good.

Singapore's GST Hike

2.1.2 Direct taxes

Direct taxes are **taxes on income and wealth** and are **paid to the tax authorities directly by the economic agent** with the income/wealth. Direct taxes can be imposed on households (consumers) in the form of personal income taxes.

Key Point:
Direct taxes shift demand.

Direct taxes affect the willingness and ability of households to consume goods and services, and **leads to a leftward shift of the demand curve**.

Assuming that the government increases direct taxes (e.g. raise personal income tax), this reduces disposable incomes of consumers, hence leading to a fall in purchasing power and a fall in demand for goods and services in general. In the market for goods and services, the demand curve shifts from D_0 to D_1 in Figure 11. The rise in direct tax will cause price to fall from P_0 to P_1 and quantity to fall from Q_0 to Q_1.
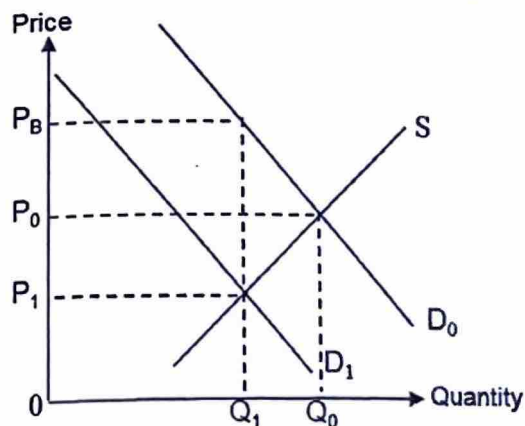
Figure 11: Effect of direct tax on market for food

Note that direct taxes such as personal income create negative welfare effects on households/consumers as it reduces their disposable incomes, hence reducing their ability to purchase goods/services.

2.2 Subsidies

Subsidies are cash transfer from the government to the producer or consumer, and can be used by governments to resolve market failure and/or as a response to inequity. Subsidies

may be granted indirectly or directly, depending on whether the subsidy is granted on expenditure on goods and services, or on income and wealth.

When analysing the effects of a subsidy, economists analyse the 'incidence' of a subsidy.

- The **incidence of the subsidy** is the distribution of the share of subsidy between sellers and buyers. The incidence of the tax might fall more on the seller or the buyer, depending on how either is ultimately is affected by the subsidy.

Key Point:
The benefit of subsidy is always shared between buyers and sellers.

2.2.1 Indirect subsidies

Indirect subsidies work like negative indirect taxes. They are **granted by the tax authorities indirectly to the suppliers of the goods and services**, instead of to the consumer. Indirect subsidies can also come in the form of a **specific subsidy** (fixed sum per unit sold) or an **ad valorem subsidy** (certain percentage of the price of the good).

Key Point:
Indirect subsidies shift supply.

Since indirect taxes are granted producers of the good or service, it decreases the cost of production for firms and leads to a rightward shift of the supply curve. **Specifically, when a subsidy is granted, the supply curve shifts downwards by the amount of the subsidy.**

Type of indirect subsidy	Shift in Supply	Diagram
Specific subsidy	A specific subsidy will shift the supply curve vertically downwards by the amount of the subsidy ($s). Since the amount of subsidy is the same at all prices, supply curve shifts parallel downwards (or shifts rightwards) from S_0 to S_1.	Market for Healthcare
Ad valorem subsidy	An ad valorem subsidy is pegged at a certain percentage of the price of the good. As price rises, the amount of subsidy granted rises. This results in a downward (or rightward) pivotal shift of the supply curve from S_0 to S_1.	Market for Restaurant Food

Note: If the details of a subsidy are not specified, it can be assumed to be an indirect subsidy for the purpose of analysing its effects.

Assuming that the government imposes an indirect subsidy (e.g. a specific subsidy of $10), the supply curve shifts from S_0 to S_1 in Figure 12. The granting of an indirect subsidy will cause price to fall from P_0 to P_1 and quantity to rise from Q_0 to Q_1. There will be an increase in government expenditure on subsidies of P_1P_sac.

Note:
It is important to analyse the impact of subsidies on equilibrium price, quantity and government expenditure.
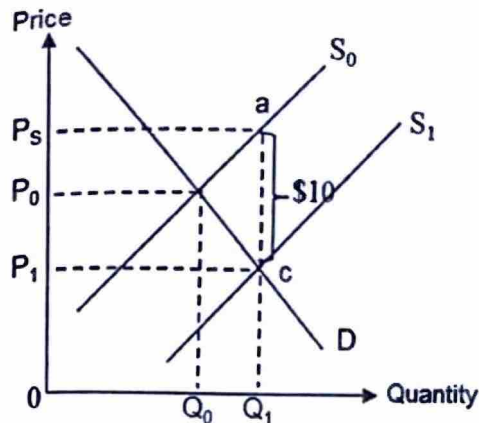
Figure 12: Effect of indirect subsidy (specific) on market for food

However, note that the equilibrium price does not fall by the full amount of the per unit subsidy (i.e. the difference between P_1 and P_0 is less than $10). **The full share of the subsidy of $10 is the difference between P_1 and P_S.**

- Consumers who used to pay P_0 now pay P_1 since the equilibrium price has changed after the fall in supply.
- Producers who used to receive P_0 now receive P_1 from consumers, and are granted subsidy of $10 by the government. Therefore, they receive P_S in total.
- There will be an increase in government expenditure on subsidies of P_1P_sac (subsidy per unit * Q1).

The consumers' incidence of the subsidy is reflected by the extent of the decrease in price from P_0 to P_1. The producers' incidence of the subsidy is the excess of the subsidy after the fall in price, which is P_0 to P_s. In this way, the **subsidy is shared between producers and consumers**, even though the impact of the subsidy was initially felt by the producers.

The **incidence of subsidy between consumers and producers will depend on both the price elasticity of demand and supply of the good**, more specifically the relative values of PED to PES.

Note:
You will not be required to analyse the incidence of taxes and subsidies in exams.

Relative price elasticities	Market Outcomes	Diagram
PED < PES	With the subsidy (=ac), the supply curve shifts right from S_0 to S_1. Price decreases from P_0 to P_1 while quantity increases from Q_0 to Q_1. Consumers enjoy subsidy incidence of P_0P_1, and the total share of subsidy for consumers is Area P_1P_0bc. Producers enjoy subsidy incidence of P_0P_s, and the total share of subsidy for producers is Area P_0P_sab. Government expenditure on subsidy is Area P_1P_sac in total.	

PED > PES	With the subsidy (=ac), the supply curve shifts right from S_0 to S_1. Price decreases from P_0 to P_1 while quantity increases from Q_0 to Q_1. Consumers enjoy subsidy incidence of P_0P_1, and the total share of subsidy for consumers is Area P_1P_0bc. Producers enjoy subsidy incidence of P_0P_s, and the total share of subsidy for producers is Area P_0P_sab. Government expenditure on subsidy is Area P_1P_sac in total.	

Indirect subsidies also have **impacts on the welfare of consumers, producers and society as a whole.** If market failure exists, government intervention in the form of subsidies may serve to resolve the market failure to achieve efficiency in the market. However, in the absence of market failure, indirect subsidies may result in welfare loss and inefficiency in the market instead.

Assuming the free market output level Q_0 in Figure 13 is initially allocatively efficient. When government grants an indirect subsidy to producers that causes the supply curve to shift from S_0 to S_1, there will be changes in consumer surplus, producer surplus, government revenue and society's welfare.
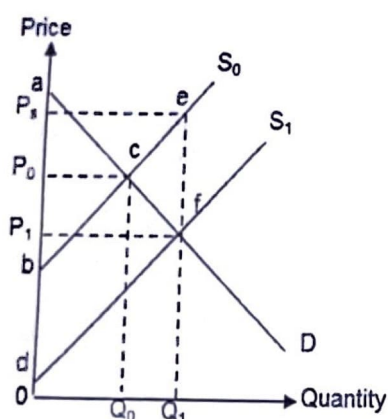
Figure 13: Effect of indirect subsidy (specific) on welfare

- Consumer surplus rises from Area P_0ac to Area P_1af. There is a gain in consumer surplus of Area P_1P_0cf.
- Producer surplus rises from Area P_0bc to Area P_sbe. There is a gain in producer surplus of Area P_0P_sec.
- Government expenditure on subsidy is Area P_1P_sef. The government expenditure comes at the expense of society's welfare, since it requires tax revenue.
- Change in society's welfare = change in consumer surplus (Area P_1P_0cf) + change in producer surplus (Area P_secP_0) + change in government expenditure ($-P_1P_sef$). There is an overall loss of society's welfare of Area cef. This constitutes a deadweight loss to society.

Consumer surplus rose because even though the maximum price consumers are willing and able to pay did not change, with the grant of the indirect subsidy, the actual price consumers have to pay has decreased from P_0 to P_1. In addition, consumers also see a rise in the quantity of good consumed from Q_0 to Q_1.

Producer surplus also rose because with the grant of the indirect subsidy, the actual price producers receive (after the government has granted the subsidy) from the selling of the goods rose from P_0 to P_s and the quantity of good sold rose from Q_0 to Q_1.

Part of the government expenditure was transferred to the society as gains in consumer and producer surpluses. However, **the gains did not fully recover the government expenditure, and society experiences a deadweight loss** because of the indirect subsidy (assuming no market failure initially). Deadweight loss represents welfare benefits that are lost to society because resources are not allocated efficiently. In this case the loss of benefits due to over-allocation of scarce resources to the production of the good arising from the indirect subsidy provided by the government.

2.2.2 Direct subsidies

Direct subsidies work like negative direct taxes, and are **granted by the tax authorities directly to the economic agent** with the income/wealth. Direct subsidies can be given to households in the form of cash grants.

> **Key Point:**
> Direct subsidies shift demand.

Direct subsidies affect the willingness and ability of households to consume goods and services, and leads to a **rightward shift of the demand curve**.

Assuming that the government increases direct subsidies (e.g. increases GST Voucher handouts), the demand curve shifts from D_0 to D_1 in Figure 14. The increase in subsidy will causes price to rise from P_0 to P_1 and quantity to rise from Q_0 to Q_1.
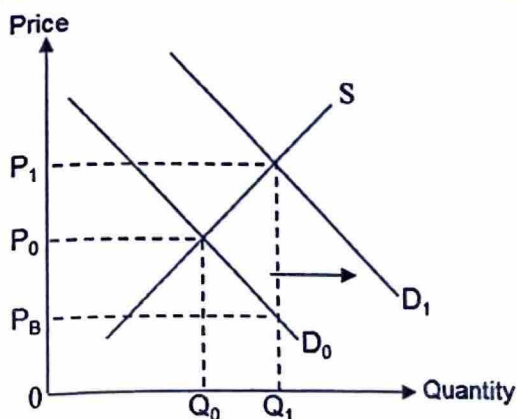
Figure 14: Effect of direct subsidy on market for food

Note that direct subsidies such as cash handouts or GST vouchers to households create positive welfare effects on households/consumers as it raises their ability to purchase goods/services.

2.3 Price controls

Price controls refer to the setting of minimum or maximum prices by the government so that prices are unable to adjust to their free market equilibrium level determined by market demand and supply. They are part of a government's prices and income policy implemented with the aim of achieving price stability and equity. However, an unintended consequence is that price controls result in market disequilibrium, and therefore results in shortages and surpluses.

2.3.1 Minimum price

A minimum price is a **price floor**, which is a legally established minimum price to prevent prices from falling below a certain level. The price is not allowed to fall below this level (although it is allowed to rise above it). To be effective, the price floor must be set **above the market equilibrium price**.

The government may set a price floor for various reasons, including:

- To protect producers' incomes, especially when prices are volatile
- To create a surplus which can be stored in preparation for future shortages
- In the case of minimum wages, to prevent workers; wage rates from falling below a certain level

A minimum price results in surplus and over-allocation of resources to the production of the good. With reference to Figure 15, the minimum price is set at P_{min}. At P_{min}, a surplus of Q_dQ_s is created. This is because at higher prices,

- Quantity demanded decreases from Q_e to Q_d (according to Law of Demand)
- Quantity supplied increases from Q_e to Q_s (according to Law of Supply)

Therefore, since $Q_s > Q_d$, **there is a surplus and the market is in disequilibrium**. The size of the surplus depends on a few factors:

- the level at which the price floor is set –**the higher the price floor/minimum price set, the greater the surplus.**
- the price elasticity of demand and supply – **the greater the value of PED and/or PES, the greater the surplus.**
- changes in demand or supply – **if demand decreases/supply increases, the surplus increases.**
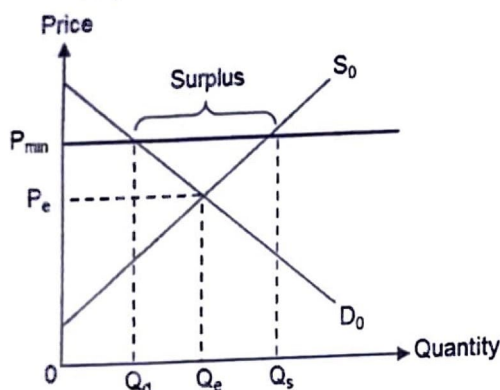
Figure 15: Effect of minimum price (price floor) on a market

Assuming the free market equilibrium level of output Q_e is allocatively efficient, the price floor results in overproduction, causing allocative inefficiency whereby too many scarce resources are allocated to producing the good.

A minimum price therefore has **impacts on the welfare of consumers, producers and society as a whole**. For instance, the government may set a minimum price on agricultural products and for the purpose of this analysis, it is assumed that the government purchases all the surpluses at Pmin to keep the minimum price policy viable.

Figure 16: Effect of minimum price on welfare

- Consumer surplus falls from Area A+B+C to Area A. There is a **loss in consumer surplus** of Area B+C because the price consumers have to pay rose from P_0 to P_{min} and the quantity of agricultural consumed decreased from Q_0 to Q_d.
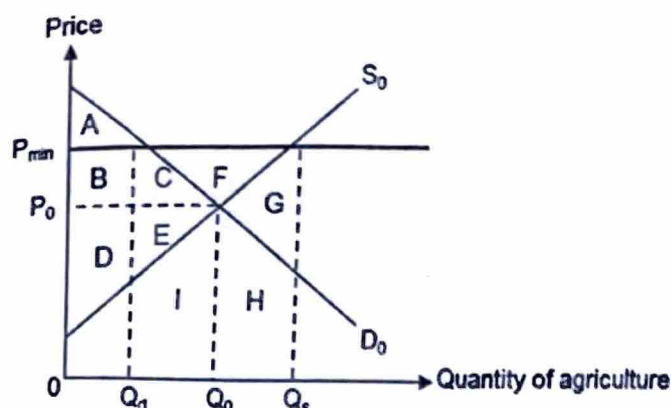- Producer surplus rises from D+E to Area D+E+B+C+F. There is a **gain in producer surplus** of Area B+C+F because the price producers receive rose, and the quantity of agriculture sold increased from Q_0 to Q_s ($0Q_d$ is bought by consumers, and Q_dQ_s is bought by the government).
- **Government expenditure on the surplus** is price (P_{min}) x quantity (Q_dQ_s), which is Area C+E+I+H+G+F. The government expenditure comes at the expense of society's welfare since it requires tax revenue.
- Change in society's welfare = change in consumer surplus [-(Area B+C)] + change in producer surplus (Area B+C+F) + change in government expenditure [-(C+E+I+H+G+F). There is an overall loss of society's welfare of Area C+E+I+H+G. This constitutes a **deadweight loss to society** (assuming that the government is unable to recover some of its expenses through the resale of the stored agriculture products or is unable to redistribute them, such as in cases when these agriculture products are perishable.)
  On the other hand, if the agriculture products (non-perishable) can be resold or redistributed, the deadweight loss incurred by the society will be significantly smaller or, in the best-case scenario in which all stored products can be resold, there might not even be a deadweight loss incurred at all.
- Opportunity cost is also incurred as government funds can be used to finance alternative development projects such as transport networks and building of schools and hospitals.

2.3.2   Maximum price

A maximum price is a **price ceiling**, which is a legally established maximum price to prevent prices from rising above a certain level. Producers are prohibited from selling above the stipulated price. To be effective, the price ceiling must be **set below the market equilibrium price**.

> **Key Point:**
> Price ceilings are set below the equilibrium price and result in shortages.

A maximum price is usually imposed with the aim of achieving some form of equity. For example, rent controls are a form of price ceiling to make housing more affordable to low-income earners or food price controls to make certain goods like necessities more affordable to low-income earners, especially during times when food prices are rising rapidly. Price capping is also an example of maximum price, where the competition authorities judge that consumers are being exploited by businesses using their monopoly power.

A maximum price results in shortage and under-allocation of resources to the production of the good. With reference to Figure 17, the maximum price is set at P_{max}. At P_{max}, a shortage of Q_sQ_d is created. This is because at lower prices,

- Quantity demanded increases from Q_e to Q_d (according to Law of Demand)
- Quantity supplied decreases from Q_e to Q_s (according to Law of Supply)

Therefore, since $Q_d > Q_s$, **there is a shortage and the market is in disequilibrium**. The size of the shortage depends on a few factors:

- the level at which the price ceiling is set – **the lower the price ceiling/maximum price set, the greater the shortage.**
- the price elasticity of demand and supply – **the greater the value of PED and/or PES, the greater the shortage.**
- changes in demand or supply – **if demand increases/supply decreases, the shortage increases.**
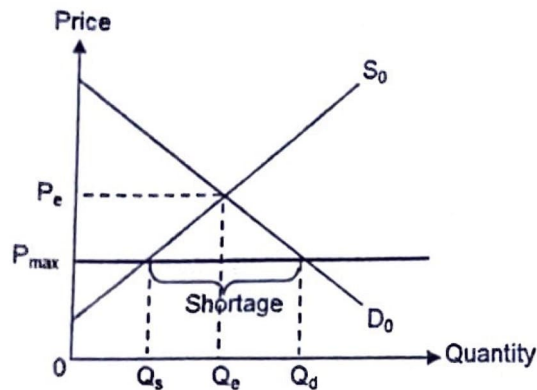
Figure 17: Effect of maximum price (price ceiling) on a market

Assuming the free market equilibrium level of output Q_e is allocatively efficient, the price floor results in underproduction, causing allocative inefficiency whereby too few resources are allocated to producing the good.

A maximum price therefore has **impacts on the welfare of consumers, producers and society as a whole.** For instance, the government may set a maximum price on basic goods such as food during wartime. With reference to Figure 18, the price ceiling is set at P_{max}. Because only Q_s is produced, the market can only trade up to Q_s regardless of the level of quantity demanded.
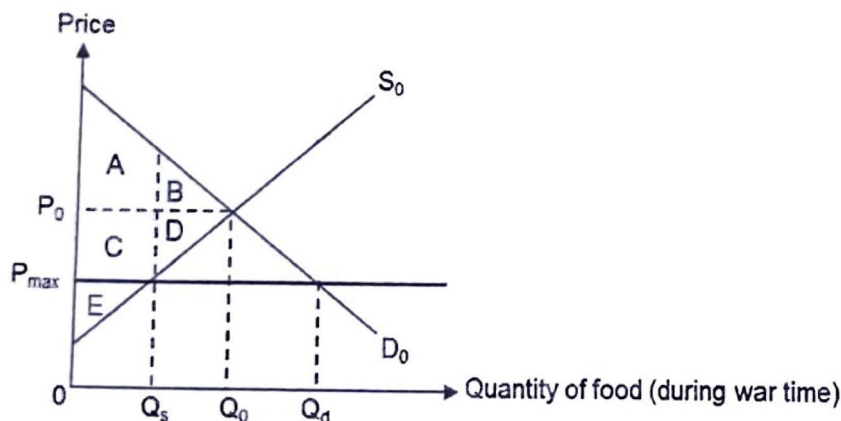
Figure 18: Effect of maximum price on welfare

- Consumer surplus changes from Area A+B to Area A+C. There is a **change in consumer surplus** of Area -B+C because the price consumers have to pay fell from P_0 to P_{max} but the quantity of food consumed decreased from Q_0 to Q_s (since

only Qs can be traded). More intuitively, those consumers who are able to obtain food at Pmax tend to benefit from the price ceiling, but consumers as a whole tend to suffer because of the fall in quantity of food available from Q0 to Qs.

- Producer surplus falls from Area C+D+E to Area E. There is **a loss in producer surplus** of Area C+D because the price producers receive fell, and the quantity of agriculture sold decreased from Q_0 to Q_s.
- Change in society's welfare = change in consumer surplus (Area -B+C) + change in producer surplus [-(Area C+D)]. There is an overall loss of society's welfare of Area B+D. This constitutes a **deadweight loss to society**.

Furthermore, there is a **need for alternative forms of non-price rationing** of food during wartime since the price ceiling causes it to be in shortage. In a free market, rationing is achieved by the price mechanism. However, price controls interfere with the price mechanism. Shortages due to price ceilings may thus result in queues if the goods are sold on a first-come-first-serve basis, or may require the distribution of limited coupons to interested buyers, or even cause the restriction of sales to favoured customers. This may hurt the group of people the policy is intended to help.

Also, an **underground market (or black market)** may emerge as a result of the price ceiling, where people ignore the government's price ceiling and sell illegally at free market prices. With reference to Figure 19, due to the shortage of Q_dQ_s at the maximum price of P_{max}, some consumers will be willing to pay a price above P_{max} to get hold of the good. Specifically, consumers could be charged the highest price they would be willing and able to pay, which is up to P_B by unscrupulous sellers.

The Case of Venezuela
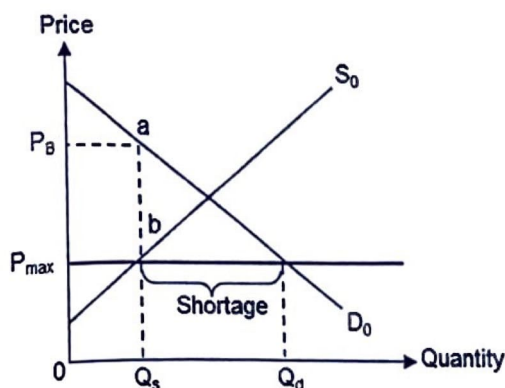
Figure 19: Black market resulting from price ceiling

To minimise the problems arising from a price ceiling, the government can encourage increase in supply through drawing on past surpluses, or engage in direct production or give subsidies or tax relief to producers. Alternatively, it can reduce demand by controlling income or producing more alternatives for the good in question. These will help to eliminate the shortage while maintaining prices at Pmax.

Question:
What are some examples of price ceiling that you can think of?

2.4 Quantity controls

Quantity controls refer to the setting of fixed output level by the government. Quantity controls also result in unintended consequences arising from the resultant disequilibrium.

2.4.1   Quotas

A quota is a **limit on the quantity produced imposed by the government through legislation and regulation.** Recall how price controls such as price ceilings and price floors must be set below the free market equilibrium price and above the free market equilibrium price respectively for them to be effective; for a quota to be effective, the quantitative restriction must be **set below the market equilibrium quantity.** The

Key Point:
Quotas are set below the equilibrium quantity.

government may decide to employ quotas as a measure to control the quantity of goods and services exchanged in the free market when they deem it to be too high.

An example of quantity control or quota would be that of production quotas that were introduced on sugar and milk in the mid-1980s as part of the reformation of the European Union's Common Agricultural Policy (CAP). Other examples include limits to the work-week to 35 hours in France, catch limits in fisheries and maximum emission limits. An extreme case of a quantity control is a total ban on the good (i.e. quota = zero).

A quota results in a reduction in the allocation of resources to the production of the good. With reference to Figure 20, the production quota for sugar/milk is set at Q^* and supply curve shifts from S_0 to S_1. At Q^*, consumers are willing and able to pay up to P_1 so the market price rises from P_0 to P_1 while the quantity is fixed at Q^*. A quota has impacts on the welfare of consumers, producers and society as a whole.
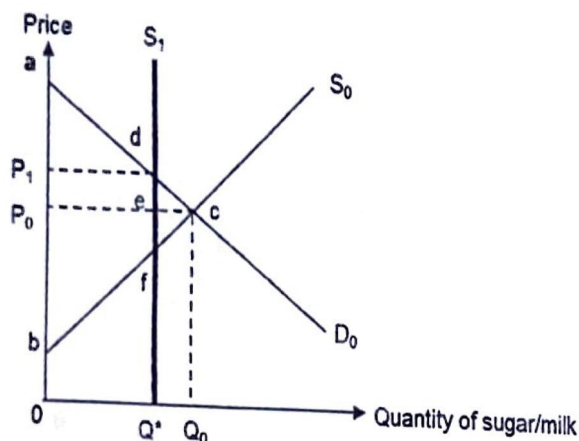
Figure 20: Effect of production quota on market for sugar/milk

- Consumer surplus falls from Area P_0ac to Area P_1ad. There is a **loss of consumer surplus** of Area P_0P_1dc because the price consumers have to pay rose from P_0 to P_1 and the quantity of sugar/milk transacted decreased from Q_0 to Q^*.
- Producer surplus changes from Area P_0bc to Area P_1dfb. There is a **change in producer surplus** of (Area P_0P_1de - ecf) because the price producers receive rose, but the quantity of sugar/milk sold decreased from Q_0 to Q^*.
- Change in society's welfare = change in consumer surplus [-(AreaP_0P_1dc)] + change in producer surplus (Area P_0P_1de - ecf). There is an overall change in society's welfare of – (Area cdf).

Sectional Summary

- Government interventions may be in the form of taxes, subsidies, price controls and quantity controls.
- Taxes are compulsory payments to the government and may be indirect or direct.
- Indirect taxes are taxes on expenditure and are paid to the tax authorities indirectly by the suppliers of the goods and services, instead of by the consumer. Indirect taxes can come in the form of specific tax (per unit tax) or ad valorem tax (percentage tax). Indirect taxes decrease supply.
- Direct taxes are taxes on income and wealth and are paid to the tax authorities directly by the economic agent with the income/wealth. Direct taxes decrease demand.
- Subsidies are cash transfer from the government to the producer or consumer and may be indirect or direct.
- Indirect subsidies work like negative indirect taxes and increase supply.
- Direct subsidies work like negative direct taxes and increase demand.

- The incidence of tax/share of subsidy is distributed between buyers and sellers, and the distribution depends on the relative price elasticities of demand and supply. The lower the PED (PES), the greater the incidence of tax/share of subsidy on the buyer (seller).
- Price controls refer to the setting of minimum or maximum prices by the government. A minimum price is a price floor, which will only be effective when it is set above the market equilibrium price. A maximum price is a price ceiling, which will only be effective when it is set below the market equilibrium price.
- Price controls result in shortages or surpluses, and they result in welfare loss to society.
- Quantity controls refer to the setting of fixed output level by the government and includes quotas. A quota is a limit on the quantity produced imposed by the government which will only be effective when it is set below the market equilibrium quantity.
- All forms of government intervention result in changes in price and/or quantity in the market. These changes may be desirable if they address market failure arising from inefficiency or inequity. However, in the absence of market failure, government distortion of the market will result in welfare losses (deadweight loss).

3. Labour Market

There are other markets in which the theory of price mechanism can be applied. Refer to *Appendix 4* for more information. One such market is the labour market.

In the market for labour, **households become sellers while firms are become buyers instead**. Households supply the labour effort that firms demand. Labour as a resource is bought and sold, and the **price of labour is called wages**. The quantity of labour traded in the market can be measured in terms of hours worked or number of employed.

> **Key Point:**
> Households are sellers and firms are buyers in the labour market. The determinants of demand and supply of labour is different from those of goods and services.

The labour market generally refers to the market for all types of workers, although its market definition can be narrowed down to specific types of labour – high-skilled, low-skilled, specialized etc. The market for engineers is an example, and in Figure 21, the Y-axis is labelled Wage while the X-axis can be labelled Quantity of Labour, Hours Worked or Employment.
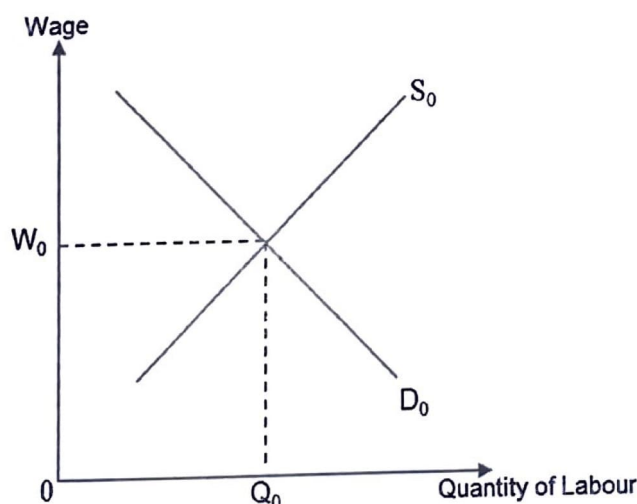

Figure 21: Market for Engineers

Since the buyers and sellers in the labour market are different from the goods market, the determinants of labour demand and labour supply would be different too.

3.1 Labour Demand

Labour is demanded for by firms, and the labour demand depends on how much revenue each unit of labour can bring to the firm. There are **wage and non-wage determinants of the demand for labour** (corresponding to price and non-price determinants of demand). The relationship between wages and quantity demanded of labour follows the Law of Demand. Other than wage, the non-wage determinants include:

- Demand for final goods and services

  The demand for labour is derived from the demand for final goods and services. A rise in market demand for the final good will increase its market price and hence marginal revenue from the sale of the additional unit. This leads to higher demand for labour because now, each unit of labour can bring in more revenue to the firm.

- Productivity of labour

  Labour productivity is defined as the level of output that is obtained from an employee (per man hour).

  An increase in productivity of labour means that each unit of labour employed is producing more output, hence able to bring in more revenue for the firm. Therefore, firms will increase the demand for labour as well.

  Education, skills-training and technological advancements may raise the productivity of labour. For example, 3D-printing technology will increase the demand for specialized engineers who know how to use such technology to augment their output.

  However, do note that advancements in technology may displace other types of labour as substitutes. For example, chatbots may reduce the need for customer service representatives, although increasing the productivity and hence demand for developers familiar with Natural Language Processing (NLP).

- Supply of alternative factors of production/complementary factors of production

  A change in the supply of alternative factors of production affects the prices of these alternatives, and firms may switch between labour inputs and these other alternative inputs. For instance, capital goods (e.g. automation machinery) may be able to replace labour. Thus, if the supply of capital goods increases resulting in a fall in price, then firms will replace labour with capital. Thus, labour demand falls.

  If the supply of a complementary factor of production rises and its price therefore falls, firms will purchase more of these factors as well as the labour required. For instance, specialized machinery can only be operated by skilled technicians and machinists. Thus, when such machinery becomes cheaper, firms purchase more of them and increase their demand for the technicians and machinists.

3.2 Labour Supply

Labour is supplied by households, and the labour supply depends on the decisions made by households when they allocate their resources (time and effort). There are **wage and non-wage determinants of the supply of labour** (corresponding to price and non-price determinants of supply). The relationship between wages and quantity supplied of labour generally follows the Law of Supply. Other than wage, the non-wage determinants include:

- Immigration

Movement of workers from country to country affects labour supply. For instance, when immigrants come to Singapore, the supply of labour in Singapore rises while the supply of labour in the immigrants' home countries decreases.

- Changes in educational attainment/job qualifications

With higher educational attainment, workers will qualify for higher-skilled jobs, and this increases their supply of labour to that particular industry. For instance, the increase in medical school graduates will increase the supply of doctors in the market for doctors. However, if job qualifications are raised (e.g. government requiring doctors to have more certification and training), then less workers will qualify for the jobs, and the supply of labour in that industry falls.

- Changes in non-wage benefits of jobs

The non-wage benefits of jobs include aspects such as the pleasantness of the work environment, job satisfaction, security, status, holidays, perks and other fringe benefits. These affect the overall attractiveness of a job which in term determines the number of people willing to work at existing wage levels, and therefore the supply of labour. For instance, increasing the medical and leave benefits of a job may increase the willingness of workers to supply their labour to the job.

- Changes in alternative employment opportunities

The relative attraction of one job compared to others will affect the supply of labour to a particular market. For instance, if drivers perceive the returns to being a private-hire car driver (i.e. Ryde, Grab or Go-Jek) to be greater than that of being a licensed taxi driver, then more drivers will switch from driving a taxi to driving private-hire cars. This results in an increase in supply of Ryde / Grab / Go-Jek drivers and a fall in supply of taxi drivers.

3.3 Wage Determination

The determination of wages in the labour market follows the price mechanism. Suppose there is immigration and supply of labour rises from S_0 to S_1 in Figure 22. At the prevailing wage rate W_0, there will be a surplus of labour (Q_0Q_s). This means that there is **unemployment**. Thus, wages will be driven downwards until the surplus is eliminated at the new wage rate W_1, where employment has risen to Q_1.
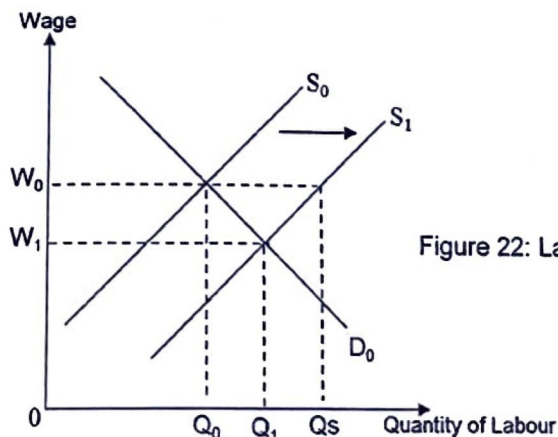
Figure 22: Labour Market Wage Determination

The falling wage has **acted as a signal and an incentive**. It signaled to firms there was surplus in the labour market, and it provided them with an incentive to hire more labour; therefore, they increase quantity demanded along the labour demand curve from Q_0 to Q_1. The lower wage is also a signal to workers, providing them with the incentive to decrease quantity supplied along the new supply curve S_1 from Q_s to Q_0, where they offer less of

their services at the lower wage. With firms and workers responding to price signals and incentives, there occurred a reallocation of labour resources with firms now hiring more labour Q_1 at the lower equilibrium wage rate of W_1.

3.4 Wage Differentials

Differences in wages across different labour markets exist in the free market because of differences in the levels of demand and supply of labour. Differences in the price elasticities of supply of labour and price elasticity of demand of labour will also determine the extent of wage changes in response to demand and supply changes. Refer to *Appendix 5* for information on the determinants of the PED and PES of labour.

> **Key Point:**
> Differences in wages can be explained by differences in demand, supply, PED and/or PES of labour.

Wage differentials may be explained by various reasons, including:

- Workers are not homogenous

The differences in the skills and abilities of workers affects the **demand for labour**, since the productivity of the labour determines the desirability of the labour to firms, affecting their willingness and ability to demand for labour. Workers that are more productive will be able to bring in more revenue for firms, and will be in greater demand than those who are less productive. The higher demand for high-skilled workers results in higher wages.

Furthermore, the **price elasticity of supply of labour** in the market also affects the wages. For instance, there is a price inelastic supply of surgeons due to the immobility of labour entering the market since it takes years to train a surgeon in medical school. Quantity of surgeons supplied cannot respond easily to wage changes. Therefore, when there is an increase in demand for surgeons, a large shortage will be created. A large rise in wages will be required in order for the market for surgeons to clear.

- Jobs are not homogenous

The differences in the jobs in terms of skills required and attractiveness of job scope and/or work environment affects the **supply of labour**. A job that requires specialized skill (e.g. lawyer) will face a limited supply of labour as unskilled workers are unable to provide labour for that market. A job that has involves higher risks (e.g. coal miners) or limited career progression will also face a reduced willingness of workers to provide their labour, and therefore a limited supply of labour as well. A lower supply of labour will result in higher wages.

The **price elasticity of demand for labour** in the market also affects the wages. For instance, there is a price inelastic demand for lawyers due to the lack for legal services. Law firms are unresponsive to wage changes, and continue to demand for lawyers even if their wages increase. Therefore, if lawyers leave the market (e.g. due to unattractive working conditions), supply of lawyers will fall and a large shortage will be created since quantity demanded by firms remains. A large rise in wages will be required in order for the market for lawyers to reach equilibrium again.

- Governments may intervene

The government can also intervene in the labour market to influence the wage rate. Minimum wages laws, determination of CPF rates (in Singapore), and restrictions on the supply of foreign workers are some examples of government intervention.

For instance, **minimum wages** exist in many European countries such as France and Germany. This is the government's response to the observation that the number of low-wage workers has increased in many European countries in the early 1990s. There are many people who work as cleaners, security guards and shop assistants, and receive very low wage rates. To protect the livelihood of these people, the government imposes a minimum wage policy on particular labour markets in an economy.
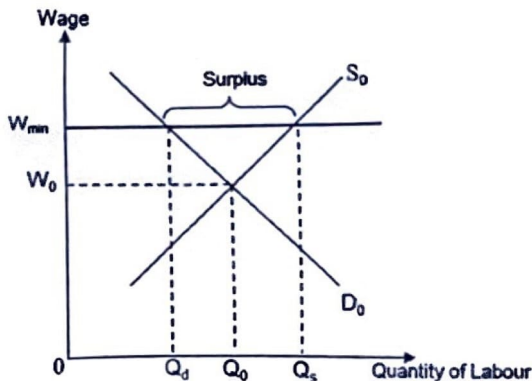
China's Minimum Wage Hike

Effects of minimum wage policy

While minimum wage policy is designed to raise the wages of the low-wage workers, it results in **unemployment and may also encourage illegal employment**. With reference to Figure 23, a minimum wage is of W_{min} is set above the free market equilibrium wage W_0.

Figure 23: Effect of minimum wage on labour market

Since wage rate has risen, quantity of labour demanded by firms decreases from Q_0 to Q_d. This represents the workers who lost their jobs as a result on the implementation of a minimum wage. At the same time, quantity of labour supplied by households increases from Q_0 to Q_s. This is because the higher wages entice more people to join the labour force, and also increases the willingness of workers to supply their labour hours. As a result, a surplus of labour arises, given by Q_sQ_d. This also indicates the level of unemployment created by the imposition of the minimum wage.

The size of the surplus created depends on a few factors:

- **the level at which the minimum wage is set.** The greater the deviation between the market equilibrium wage, W_0 and the minimum wage, W_{min}, the higher the level of unemployment.
- **the price elasticities of labour demand and labour supply.** The degree of unemployment in the affected industry depends on the PED and PES in the labour market. The degree of substitutability of low-skilled workers is high hence the PED tend to be high as well (i.e. demand for low-skilled workers is price elastic). As such, the extent of unemployment caused by the minimum wage policy will be large, limiting the effectiveness of the minimum wage policy that would have been intended to help low-skilled workers.
- **changes in demand or supply** – if demand decreases/supply increases, the rate of unemplyoment increases.

Furthermore, with higher wage rate imposed, firms would face higher labour costs. In the long run, firms might develop and switch to labour-saving techniques of production which encourages higher productivity which helps lower costs per unit of output. **Technological unemployment might arise** as high-tech production methods displace labour. Also, **illegal employment of some workers at wages below the legal minimum wage** may result. This often involves illegal immigrants who may be willing to supply their labour at very low wages. This reduces the effectiveness of the minimum wage.

- Labour market is not perfectly competitive (labour market imperfections)

While the price mechanism can be applied to the labour market to explain wage changes, it remains only a model for making general analyses. Wages isn't solely determined by free market demand and supply forces because the labour market deviates from the assumption of perfect competition in the free market.

> **Think:**
> What costs and benefits ought to be considered when deciding whether to implement a minimum wage policy?

> **Key Point:**
> Minimum wages result in unemployment, which is more significant if PED and/or PES of labour is high.

The supply of labour is not perfectly competitive. Workers (i.e. sellers of labour hours can have market power by establishing a **trade union**. An industry with a more powerful trade union will have a higher wage than other industries, since workers are not competing against each other for jobs and hence do not offer lower wages to firms. Certain professional bodies use artificial restraints as prerequisites for membership to restrict the quantity supplied in order to ask for higher wages.

The demand for labour is also not perfectly competitive. Firms (i.e. buyers of labour hours) can have market power if they are a **monopsonist**, which is a dominant buyer of factor services in the market. It can exploit its position by offering only lower wages that are below the free market level since it is the only buyer of labour.

- Non-economic factors – Discrimination

Another major reason giving rise to wage differentials is discrimination. These are differences arising due to gender, race, age, religion or disability. Traditionally, females are paid less than their male counterpart, and the elderly tend to receive lower wages.

Singapore's wages are, however, not purely determined by free market forces. Instead, a tripartite organization called the National Wages Council (NWC) gives recommendations on wages. Refer to *Appendix 6* for information about the NWC.

> **Think:**
> Do trade unions have a strong influence on wages in Singapore?

Sectional Summary

- The labour market is made of households who are sellers of labour hours and firms who are buyers of labour hours. The price of labour is called wages and the quantity of labour traded in the market can be measured in terms of hours worked or number of employed.
- The determinants of the demand for labour include the demand for final goods and services, price of final goods and services, productivity of labour, supply of alternative factors of production/complementary factors of production and changes in technology/method of production.
- The determinants of the supply of labour include immigration, changes in educational attainment/job qualifications, changes in non-wage benefits of jobs and changes in alternative employment opportunities.
- Wages are determined by market forces of demand and supply, and differentials in wages can be explained by differences in demand, supply, PED and PES.
- Wage differentials may also exist because of government intervention such as minimum wage, labour market imperfection, or for non-economic reasons (e.g. discrimination).

******END******

# Appendix 1 – Price Elasticity of Demand along a Linear Demand Curve

A straight-line demand curve has a different elasticity at each point on it. The only exceptions are a vertical demand curve (PED = 0) and a horizontal demand curve (PED = ∞). The reason for this differing elasticity can be demonstrated using the equation for a straight-line demand curve:

$$Q = a - bP$$

The term '-b' would give the slope of the demand curve if we were to plot Q on the vertical axis and P on the horizontal. Since we plot them the other way around, the term 'b' gives the inverse of the slope as plotted. The slope of the curve as plotted is given by $\frac{dP}{dQ}$; the inverse of the slope is given by $\frac{dQ}{dP} = -b$.

The formula for price elasticity of demand (using the point elasticity method) is:

$$PED = \frac{dQ}{dP} \times \frac{P}{Q}$$
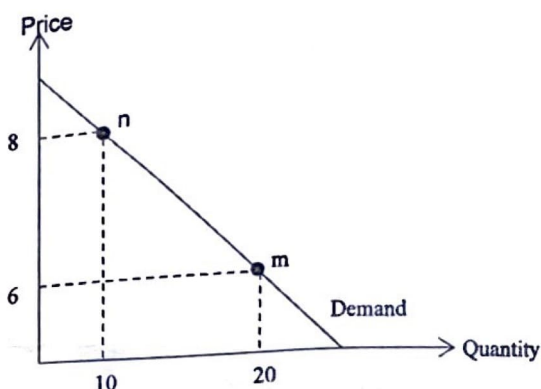
This can thus be rewritten as:

$$PED = -b\frac{P}{Q}$$

This is illustrated in the diagram, which plots the following demand curve:

$$Q = 50 - 5P$$

The slope of the demand curve $\frac{dP}{dQ}$ is constant (i.e. $\frac{8-6}{10-20} = \frac{2}{-10} = -0.2$). The inverse of the slope $\frac{dQ}{dP}$ is thus -5. In this example, price elasticity of demand is given by:

$$PED = -5\frac{P}{Q}$$

The value of $\frac{P}{Q}$, however, differs along the length of the demand curve. At point n, $\frac{P}{Q} = \frac{8}{10}$. Thus,

$$PED = -5\left(\frac{8}{10}\right) = -4$$
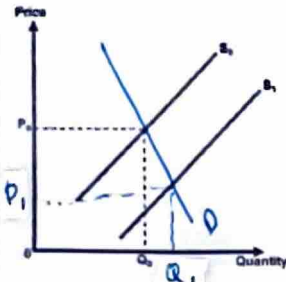
At point m, however, $\frac{P}{Q} = \frac{6}{20}$. Thus,
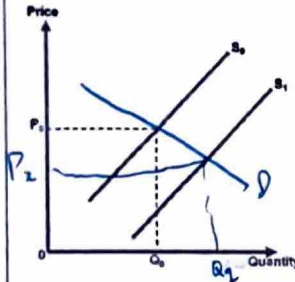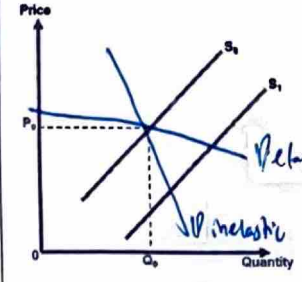
$$PED = -5\left(\frac{6}{20}\right) = -1.5$$

Source: Sloman, J. et.al (2015). Chapter 3.1 Elasticity

> **Note:**
> Many students are curious about what university level economics looks like. This appendix is a good taster of some of the math involved in university level economics.
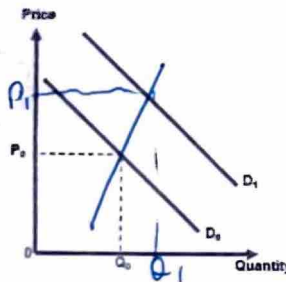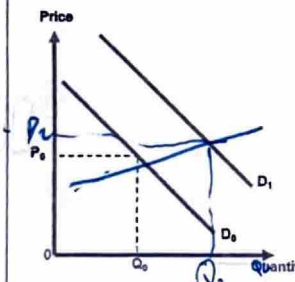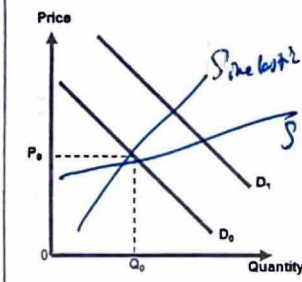
Appendix 2 – Exercises on Applications of PED and PES

Using PED to analyse the impact of an increase in supply:

If demand is price inelastic:	If demand is price elastic:	Comparing both:
Fall in price from _Po_ to _P₁_ will cause _less_ _than proportionate_ rise in quantity from _Q0_ to _Q₁_.	Fall in price from _Po_ to _P₂_ will cause _more than proportionate_ rise in quantity from _Q0_ to _Q₂_.	Fall in price is _large_ when demand is price inelastic compared to when demand is price elastic.
Total revenue _decreases_.	Total revenue _increases_	

Using PES to analyse the impact of an increase in demand:

If supply is price inelastic:	If supply is price elastic:	Comparing both:
Rise in price from _Po_ to _P₁_ will cause _less_ _than_ _proportionate_ rise in quantity from _Q0_ to _Q₁_.	Rise in price from _Po_ to _P₂_ will cause _more_ _than_ _proportionate_ rise in quantity from _Q0_ to _Q₂_.	Rise in price is _larger_ when supply is price inelastic compared to when supply is price elastic.

Appendix 3 – Exercises on Incidence of Indirect Tax/Subsidy

Incidence of a specific indirect tax:
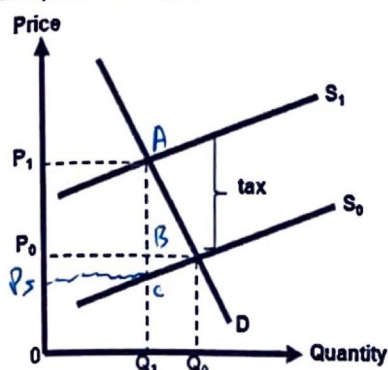
If demand is relatively less price elastic compared to supply:	If demand is relatively more price elastic compared to supply:
Consumers pay _P_1_. Producers receive _P_S_ (after paying tax). Consumers' burden of tax is _$P_0 P_1 AB$_. Producers' burden of tax is _$P_S P_0 BC$_. _Consumers_ bear a greater burden.	Consumers pay _P_1_. Producers receive _P_S_ (after paying tax). Consumers' burden of tax is _$P_1 P_0 AB$_. Producers' burden of tax is _$P_0 P_S BC$_. _Producers_ bear a greater burden.
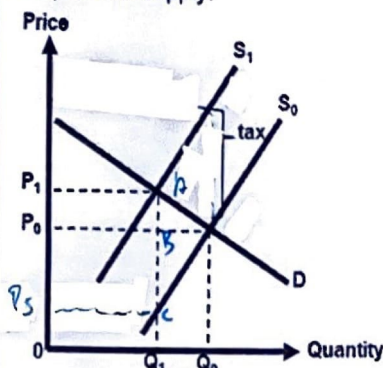
Incidence of a specific indirect subsidy:
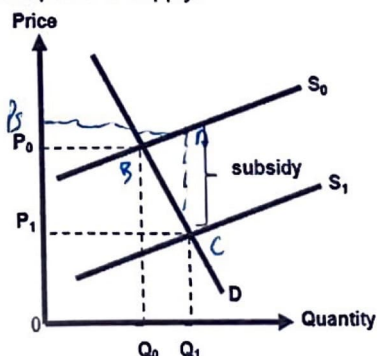
If demand is relatively less price elastic compared to supply:	If demand is relatively less price elastic compared to supply:
Consumers pay _P_1_. Producers receive _P_S_ (after subsidy). Consumers' share of subsidy is _$P_S P_0 AB$_. Producers' share of subsidy is _$P_0 P_1 BC$_. _Consumers_ enjoy a greater share.	Consumers pay _P_1_. Producers receive _P_S_ (after subsidy). Consumers' share of subsidy is _$P_1 P_0 BC$_. Producers' share of subsidy is _$P_0 P_S AB$_. _Producers_ enjoy a greater share.
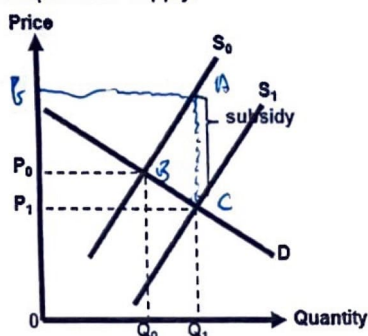
Appendix 4 – Application of Price Mechanism to Different Market Arenas

There are three main market arenas in which households, firms and the government interact – the goods and services market, the resource market, and the money market. The demand-supply analysis that underpins the price mechanism can be applied to all three arenas. In different types of market, the roles of buyer and seller may change for economic agents since it will depend on what is being traded.

Goods and Services Market (Product Market)

Generally, households are buyers and firms are sellers in the market for goods and services. Households demand the goods and services produced by firms who supply them. A price for the good/service is determined by the interactions between household and firms and the quantity of the good/service traded is also determined at the equilibrium price. Examples of such markets abound – food, clothing, etc. The market for computers is a specific example, and in a diagram, the Y-axis is labelled Price while the X-axis is labelled Quantity.
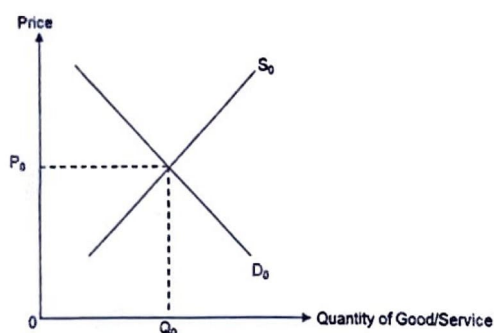
Resource Market (including Land and Labour)

In the market for resources, households are sellers and firms are buyers instead. Households own factors of production such as land and labour and they sell them to firms who use these factors for production. The price of land, which is rent, as well as the price of labour, which is wage, is determined by the interaction of demand and supply forces. In a diagram for the land market, the Y-axis is labelled Rent. For the labour market, it is labelled Wage.
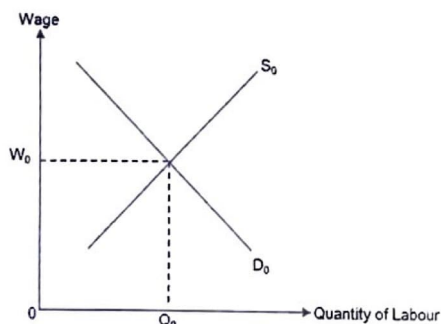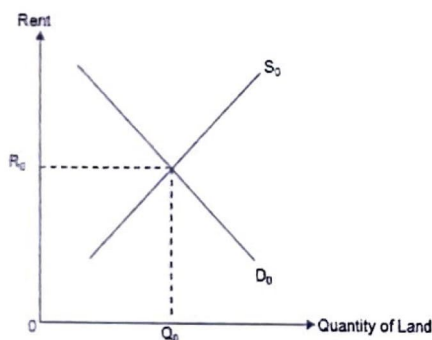
Money Market (Financial Market)

There also exists a money market where households supply money in the form of deposits or purchase of stocks/bonds. Governments also control the supply of money by issuing or buying bonds, printing or destroying cash notes or changing bank reserve requirements. The buyers of money are economic agents who demand for loans, including firms and households. Much of the borrowing and lending activities carried out between households, firms and governments are coordinated by financial institutions such as commercial banks, savings and loans associations, insurance companies and the likes. These institutions take deposits from one group and lend them to others.

The price of money/funds/financial instruments is the interest rate on the instrument. This is because to borrow a fund, the borrower needs to pay the lender the interest rate as a payment for the loan. In a diagram for the money market, the Y-axis is labelled interest rates.
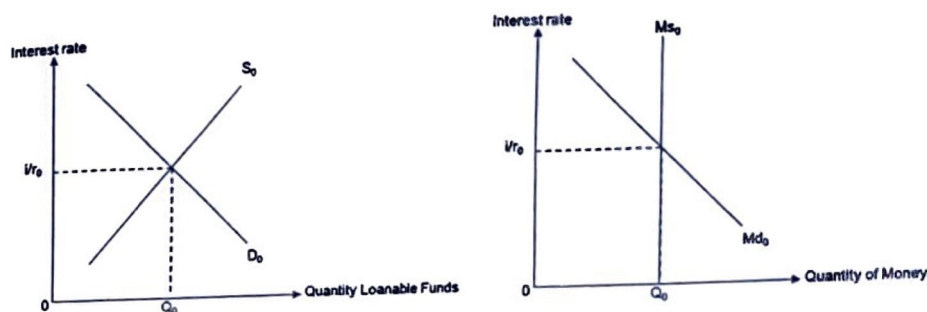
It is worth noting that there are different forms of money, and therefore, there are also different markets for the different forms of money. Each market has its own interest rates, although there is a tendency for interest rates to move in the same direction.

Appendix 5 – Determinants of PED and PES of Labour

As in all markets, elasticities will affect the extent of wage change when labour market conditions change.

The elasticity of demand for labour is the degree of responsiveness of the quantity demanded of labour to a change in the wage rate, ceteris paribus. Its determinants include:

- Ease of Substitution (Does labour have close substitutes?)
- Proportion of Labour Cost to Total Cost (Does labour take up a huge proportion of total cost for the firm?)
- Price-elasticity of Demand for final product (since labour is a derived demand, its elasticity of demand is determined by that of the product).
- Time period (With time, firms are better able to make adjustments, develop alternatives to labour, switch to capital intensive industries)
- Rate of diminishing returns (*Covered in Firms and How They Operate*)

The elasticity of supply of Labour is the degree of responsiveness of the quantity supplied of labour to a change in the wage rate, ceteris paribus. Its determinants include:

- Length of Training – It takes time to train labour. In the short run, any wage increase will not be met by an increase in quantity supplied of labour if the time taken to train labour is long. Such industries have inelastic supply of labour.
- Special Aptitudes –Supply of labour for jobs requiring special inherent abilities or skills is more price inelastic compared to other common jobs. E.g. footballers able to execute brilliant free kicks.
- Geographical Immobility – This is essentially the lack of willingness of people to move to jobs in other parts of the country. This may arise due to a variety of reasons such as financial cost of relocating, inconvenience of moving, social and family ties, poor availability of housing in the new areas, etc.
- Occupational Immobility – This refers to the lack of willingness of people to move to other jobs irrespective of location. Reasons may include less desirable working conditions, ignorance of available jobs elsewhere, fear of the unknown etc.
- Contracts/Bonds – This affects the mobility of the labour during the bond period.

Appendix 6 – Wage Determination in Singapore

In Singapore, wages are largely determined by demand and supply levels existing in each market. However, there is some degree of government intervention. This is because labour cost is an important determinant of the country's competitiveness and greatly influences the country's economic growth. Government intervention here can be seen in its influence via the National Wages Council as well as on the supply and demand of labour.

The National Wages Council (NWC) was set up in Feb 1972 to formulate wage guidelines in line with Singapore's social development and long-term economic growth. The council meets every year to deliberate on wage and wage-related matters, and issues guidelines on these matters every year based on tripartite consensus. The NWC is a tripartite body consisting of representatives from three parties, namely:

1. The Ministry of Manpower (MOM) which aspires to develop a globally competitive workforce and a great workplace, for a cohesive society and a secure economic future for all Singaporeans.
2. The National Trades Union Congress (NTUC) is a national confederation of trade unions in the industrial, service and public sectors representing over 500,000 workers in Singapore. NTUC's objectives are to help Singapore stay competitive, workers to remain employable for life and enhance the social status and well-being of workers. NTUC's vision is to be an inclusive labour movement for all collars, all ages and all nationalities.
3. The Singapore National Employers Federation (SNEF) was established in 1980. SNEF is a trade union of employers dedicated to preserving industrial harmony and helping employers achieve excellence in employment practices, thereby enhancing productivity, competitiveness as well as the quality of employees' work life.

The NWC periodically releases guidelines or recommendations on wages. Generally, the wage guidepost stipulates that any increases in wage rate should not exceed the rise in productivity levels so as to keep our unit costs low. The aim is to maintain Singapore's international competitiveness. Although these guidelines are not mandatory, they are applicable to all employees, unionised and non-unionised companies in both the public and private sector.

BLANK PAGE

RAFFLES INSTITUTION
YEAR 5 H2 ECONOMICS 2022

TUTORIAL PACKAGE

Section A: Multiple Choice Questions

1. Why does an individual's demand curve for a good usually slope down from left to right?

   a. There is increasing opportunity cost along the production possibility frontier.
   b. Marginal utility diminishes as consumption increases.
   c. Prices diminish because the individual's purchases increase.
   d. Producers offer more for sale at a lower price than at a higher price.
   e. Production costs fall as output increases for consumers who purchase higher quantities.

2. In deriving the demand curve for a good, which of the following is allowed to vary?

   a. income
   b. the price of the good being considered
   c. the prices of all other goods
   d. population
   e. tastes

3. The diagram shows the demand curve for good X.
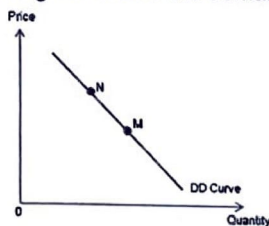
   What could cause a movement along the curve from N to M?

   a. a change in consumer tastes
   b. a decrease in labour costs
   c. a decrease in demand for X
   d. an increase in the price of a substitute good

4. In diagrammatic terms, other things remaining the same, a fall in the price of a commodity will normally shift

   a. the demand curve for the commodity to the right
   b. the demand curve for a substitute to the left
   c. the demand curve for a complement to the left
   d. the supply curve of the commodity to the right
   e. none of the above

5. Assuming that jam and honey are substitutes and that honey and beeswax are in joint supply, other things being equal, what will be the result of an increase in the price of jam?

	Price of honey	Price of beeswax
a.	fall	fall
b.	fall	no change

c.	fall	rise
d.	rise	fall
e.	rise	rise

6. The diagram shows the demand and supply curves for a commodity.
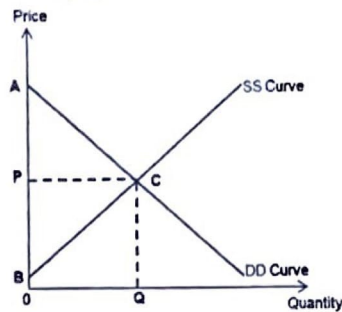
Which of these pairings are correct?

	Area	Represents
a.	0ACQ	Consumer surplus
b.	0PCQ	Consumers expenditure
c.	0BCQ	Producers surplus
d.	ABC	Producers revenue
e.	APC	Societal welfare

7. Which of the following are normal goods?

(i) A good with price elasticity of demand of 0.5
(ii) A good with price elasticity of demand of 2
(iii) A good with income elasticity of -0.5
(iv) A good with income elasticity of demand of 0.7
(v) A good with income elasticity of demand of 3

a. (i) and (ii)
b. (ii) and (v)
c. (iv) and (v)
d. (iv) only
e. (v) only

8. In the diagram, D is the demand curve for a commodity. S_1 and S_2 are the supply curves before and after intervention by the government.
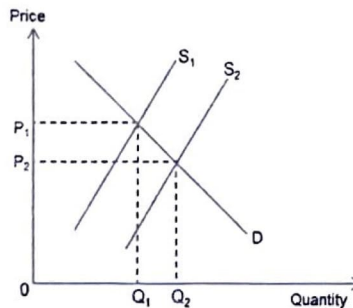
What action has the government taken?

a. It has given producers a subsidy to encourage greater output.
b. It has given a subsidy to consumers.
c. It has raised the price to consumers to ration the quantity available.

d. It has imposed an indirect tax to discourage production.
e. It has purchases a quantity of $Q_1 - Q_2$ for government use.

9. The demand for smart phones increases, while the cost of producing them decreases. What will be the effect on the price of smart phones and on the quantity traded?

	Price	Quantity traded
a.	fall	uncertain
b.	rise	uncertain
c.	uncertain	increase
d.	uncertain	decrease
e.	uncertain	uncertain

10. The diagram illustrates the effects of placing a specific tax equal to JM on a good.
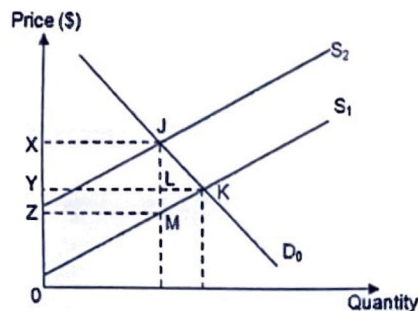
Which area represents the total tax receipts?

a. XJKY
b. XJLY
c. XJMZ
d. JKM

Section B: Short Structured Questions

1. Analyse the effects of the following changes on the poultry market. Distinguish between a shift of and a movement along the supply curve and indicate the direction of the shift or movement.

(a) The demand for poultry increases.
(b) Imported meats, including poultry, from United States are allowed into the country as a result of trade agreements made by the government of the country with the US government.
(c) Modern farming techniques are introduced to the country that allows more chickens to be reared and at cheaper cost.
(d) The government imposes a price ceiling on poultry, preventing the sale of poultry above 80% of the existing price.

(*Challenge yourself*. Evaluate also the **extent** to which the changes in supply or quantity supplied occur, and give reasons to support your evaluation.)

2. Answer the following questions using the data provided.

Table 1: Income elasticity of demand of Japanese consumers for meat products in Japan

Beef	0.76
Poultry	0.02
Pork	0.38

Source: *Economic Research Service/USDA*

Table 2: Price elasticity of demand of Japanese consumers for chilled beef imported from different countries

Australia	(-) 0.92
United States	(-) 1.13
Rest of World	(-) 1.18

Source: *Economic Research Service/USDA*

Extract 2: The Market for Beef Imports into Japan

There is a tendency for Japanese consumers to import more Australian beef products when US beef prices rise and vice versa. The results show a particularly strong competitive relationship for chilled beef across all sources, where a price increase in beef from one source leads to increased imports from the other two sources, ceteris paribus. A 1% increase in the price of Australian chilled beef for example, would cause imports of US chilled beef to increase by 0.74% and chilled beef from the rest of the world to increase by 1.34%.

(a) With reference to Table 1, explain which meat product is considered more of a necessity by consumers in Japan.   [2]

(b) Suppose the price of imported chilled beef rises. Explain what would happen to total spending by Japanese consumers on imported chilled beef from (i) Australia and (ii) the Rest of the World   [4]

(c) Using the information in Extract 2, calculate and interpret the cross elasticity value of demand in Japan between Australian chilled beef and (i) US chilled beef and (ii) chilled beef from the rest of the world.   [4]

3. Answer the following questions using the data provided.

Table 2: Income elasticity of demand for electricity in selected countries

These elasticity values have been calculated by comparing Gross National Income (GNI) per person with electricity consumption per person over the period 1991 to 2010.

Country	Income Elasticity of Demand
Australia	0.60
Japan	0.74
Bangladesh	1.91

Source: Asian Development Bank, 2016

(a) Explain one possible reason for the difference in values of income elasticity of demand for electricity in Bangladesh and Australia.   [4]

4. The figure in the next page shows the market for food in which a country is self-sufficient. The market price of P_1 is regarded as too low and the government wants farmers to receive a price of P_2.
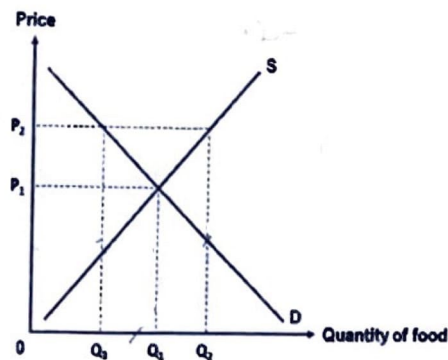
(a) Assume first that farmers are paid a guaranteed minimum price of P_2.
   i.   How much will the government want to buy from the producers?
   ii. How much will it cost the taxpayers?
(b) Assume now that the government, instead of paying a minimum price, gives an output subsidy.
   i.   What must be the size of the subsidy per unit of output to have the same effect on farmers' incomes as the minimum price of P_2.
   ii. How much will it cost the taxpayers?
(c) What are potential problems that can occur when the government imposes a price floor?

Section C: Case Study Questions

Question 1 – Global Food Crisis

Extract 1: Surging Food Prices

Everywhere, leaders are scrambling to find solutions to a phenomenon which, according to World Bank, has condemned 44 million people to malnourishment, with serious consequences for political stability. Consumers in the United States or Britain can afford to absorb price rises as they spend only about 10% of their disposable income on food. But in Africa or poorer Asian countries such as Indonesia, Sri Lanka and the Philippines, where many households spend 50% to 70% of their total budget on food, desperation and starvation often follow an uptick in the price of something as simple as bread or rice.

World Bank president Robert Zoellick noted last month that food price inflation is "the biggest threat today to the world's poor". During the 2007-09 period, the main problem was the shortage of rice caused by droughts in key producing countries, coupled with weakening global demand and falling oil prices as a result of the financial crisis during 2008-2009. However, the fundamental causes of the long-term "price inflation" is the result of far more intractable developments.

The first factor is the rising trend in the price of oil. Rising oil prices lead to higher fertilizer cost, as well as bigger expenditures on running farm machinery and irrigation equipment. Oil prices also raise the cost of transporting food to markets. And they also encourage the greater use of food products such as corn and sugar in the production of biofuels.

A second factor is changes in consumption. Each year, the world's farmers must feed 80 million additional people. The farming industry has coped with the doubling of the world's population since 1970s through more intensive and efficient production. But it is less able to cope with a new phenomenon: the movement of three billion people up the food chain.

As families in emerging economies join the ranks of the middle classes, their diet expands to items such as meat which, only a generation ago, were regarded as luxuries. The people of China, for instance, now consume 2.4 times more meat than a decade ago. With more people eating meat and global production of livestock rising, so does the demand for extra corn and soya beans as animal feed.

Governments have not helped matters either. For agriculture is still exempt from the operation of a free market; every food producing country maintains strategic stocks as well as a variety of hidden and open subsidies for farmers. The European Union's extensive subsidies system under the "common agricultural policy" results in unnecessary food surpluses which distort markets. Most of the surpluses end up either destroyed or dumped on world markets.

Source: The Straits Times, 21 May 2011

Extract 2: Crisis Prevention

Over the coming decades, food production will have to rise by more than 70% by 2050 to keep pace with population growth, the explosion of developing countries' megacities and the changes in diet that wealth and urbanization bring. Big increases will be harder to achieve than in the past because there is little unfarmed land to bring into production, no more water and in some place, little to be gained by heaping on more fertilizer. Climate change may well exacerbate these problems. For the first time since the 1960s the yields of the world's most important crops, wheat and rice, are rising more slowly than the global population. The world cannot feed today's 7 billion people properly. How on earth can it feed the expected 9 billion in 2050?

If 9 billion people are to be fed in 2050, countries that produce a miserable one tonne per hectare will have to produce two, the vast amount of food wasted on poor countries' farms – a third or more of the total – must be saved; and plant breeders will have to reverse the long decline in yield growth. All these things require higher returns to farmers, which will attract higher investment. Without these, there will not just be a billion hungry people but a billion extra in 2050. Somehow, returns to farmers must rise without inflicting untold misery on the poor.

It can be done. Targeting help to the poorest is part of the solution. Conditional cash-transfer programmes, such as Mexico's *Oportunidades* and Brazil's *Bolsa Familia* (in which the mother gets a small stipend on condition her children attend school and get a health check-up), can work well: 70% of the Bolsa payments go on food.

Countries should scrap targets for biofuels which favour an expensive, environmentally damaging business that needlessly distorts food markets. America's ethanol subsidy is a particularly egregious offender. Even opening up retailing to foreigners can help: companies such as Wal-Mart are good at getting food onto supermarket shelves rather than leaving it to rot in the fields.

Although governments can help a lot by getting out of the way in what has been a woefully distorted market, in one respect they need to do more, by reversing the decline in public spending on agricultural research. Unlike other farm subsidies, basic research works. The Green Revolution began with public research. So did Brazil's recent farming successes. Western countries have not learned the lesson. Basic farm research helps the whole world – and is a bargain. One billion dollars would provide many billions of benefits in terms of people fed and food riots forestalled.

Source: *The Economist*, 24 February 2011

Figure 1: Food price index, 2000-2011
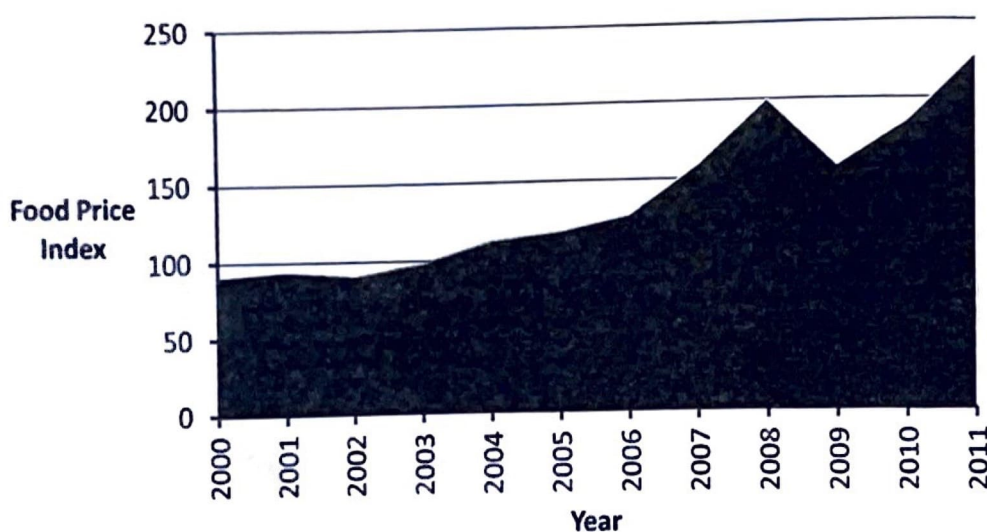
Source: *Food and Agriculture Organization Of The United Nations, Apr 2012*

Table 1: Projected growth of national income of selected countries, 2005-2050

Country	Average annual growth (%)
Emerging economies	
India	5.2
Indonesia	4.8
Turkey	4.2
China	3.9
Advanced economies	
Germany	1.8
Italy	1.6
Japan	1.6

Source: *PricewaterhouseCoopers, March 2006*

Questions

(a) (i) Describe the trend of food prices in Figure 1. [2]

(ii) With the aid of a diagram, account for the above trend. [5]

(b) (i) Define price elasticity of supply. [1]

(ii) With reference to extract 2, what can be deduced about the price elasticity of supply for food and the implication on food prices? [4]

(c) With reference to extract 1 and table 1, discuss the usefulness of the concepts of price and income elasticity of demand to producers of food crop and livestock. [8]

(d) Evaluate the effectiveness of two policies governments can adopt to tackle the food crisis. [10]

Question 2 – The UK air travel market

In January 2009 the UK government decided to support a third runway at Heathrow Airport, committing to a significant expansion of air travel. Alongside this decision, however, the Government set a target that carbon emissions form UK air travel in 2050 should be at or below 2005 levels.

Extract 1: Meeting the UK air travel target and reducing carbon emissions

Demand for air travel in the UK has grown by 130% over the past 20 years. This is against a background of an increase in GDP of 54% and a significant fall in air fares. Given the forecast real income growth of around 150% in the period to 2050 we project the demand for air travel could grow by over 200% from 230 million passengers per year in 2005 to 695 million passengers in 2050.

However, the increase in demand for air travel will result in higher carbon emissions. There have been talks about measures to tackle this issue. Imposing a tax on the carbon emissions of aircraft and limiting the capacity of UK airports could reduce demand growth to 115% by 2050. In addition there is scope for a significant shift to high-speed rail travel on domestic journeys and short-haul trips to mainland Europe, which could reduce demand for air travel by up to 8% by 2050. This will, however, require significant investment in rail travel. There is also some scope for substitution of videoconferencing for business travel. This could lead to a reduction of up to 30% in business demand for air travel by 2050. Carbon emissions could also be reduced by an improvement in the efficiency of aircraft engines and in air traffic management. In addition alternative fuels will help to cut emissions.

Source: Committee on Climate Change Report, December 2009

Extract 2: Fresh taxes needed to curb rise in air travel

More taxes on air travel are needed in Britain is to meet its climate change obligations according to Government advisers. In a report published today, the Committee on Climate Change (CCC) has called for a drastic action to curb the predicted growth in air travel including higher taxes on air fares. Holidaymakers are already facing sharp increase in Air Passenger Duty which, by the end of next year, will mean a family of four flying to America will pay £240 in tax. 'Air tickets are going to get a lot more expensive, but people will become a lot richer over the next 40 years. If you're going to limit the growth in demand, you do need rising prices, 'said the Committee's chief executive. 'It's not that demand has to fall in order for us to meet the target, demand can increase but only in a limited way."

Despite calling for curbs on airport expansion, the Committee stopped short of calling for plans for Heathrow's third runway to be abandoned.

The report was welcomed by environmental groups. One campaigner said, 'this report is a reality check which should finally put an end to Government plans to allow a huge expansion in air travel. The Committee says that technology can significantly cut the impact that individual flights have on our climate – but if air travel grows to the dangerous level that industry is pushing for, these benefits will be completely outweighed.'

However, the air travel industry insisted that it could meet the carbon reduction targets without restricting demand for flights. 'We have already seen a 70% improvement in carbon emissions in the last 40 years. We believe limiting emissions is the answer rather than limiting people's ability to travel. From 2012, carbon emissions from UK flights will be included in a European Union (EU) scheme, whereby any increase in emissions above the 2005 baseline will have to be matched by equivalent reductions elsewhere, paid for by the air travel industry,' said the executive chairman of the Airport Operators Association.

The chief executive of a short-haul airline added: 'The key to sustainable air travel is technology, not taxation, and the way to make sure it happens is by setting minimum standards for aircraft emissions.'

David Millward, *Daily Telegraph*, 8 December 2009

Extract 3: Raising air fares will lower the chances of more environmentally friendly aircraft

The ability to travel combined with the fall in air fares has driven the surge in demand for flights, not just to the UK, but throughout Europe. But a recent report by the Civil Aviation Authority, produced in September, confirms that there has been an exceptional surge in migrant travel to and from Europe. It is this, rather than an increase in holiday or business travel, that has led to the increase in demand for flights since 1990. The question is whether this rise will continue and there is evidence that the rise is beginning to level off. If that is the case, one has to question whether there is any real justification in artificially forcing up air fares, which will not only make air travel the preserve of the rich, but also deny airlines, many of which are making losses at the moment, the money they need to invest in cleaner, more environmentally friendly aircraft in the future.

David Millward, *Daily Telegraph*, 9 December 2009

Extract 4: The rise in flights to visit friends or relatives

In recent years, an increasingly globalized world economy has led to a rise in labour mobility and migration, particularly within Europe. At the same time, there has been a relaxation of regulatory restrictions on aviation markets and this has encouraged increases in flights.

There is a subset of leisure passengers who travel for the purpose of 'Visiting Friends or Relatives' (VFR). Between 2000 and 2007, whilst total passengers to and from the UK grew by one-third, those travelling for the purpose of VFR increased by over three-quarters, much more than the growth in business and holiday travel.

Looking forward, the current worldwide economic downturn is likely to impact upon VFR traffic, both through falls in UK GDP and changes in migration patterns. For these people, travel for VFR purposes is an indication of the desire to build and maintain relationships. The analysis in this study has been carried out using data which cover a period of significant change in terms of the increase in the number of countries belonging to the EU, the migration flows this has enabled and the liberalization of the EU air travel market (giving rise to more affordable air travel). In light of these one-off developments, it may not be realistic to assume continued growth of the same magnitude.   •

Source: UK Civil Aviation Authority Report: International Relations – *The Growth in Air Travel to Visit Friends or Relatives*, 2009

Table 1: Estimates of elasticities for flights from UK airports

	Price elasticities of demand	Income elasticities of demand
Business flights to UK destinations	n/a	1.4
Leisure flights to UK destinations	-1.0	1.5
Business flights to non-UK destinations	n/a	0.6
Leisure flights to non-UK destinations	-0.2	0.7

n/a = not available

Source: UK Department for Trade, 2009

Questions

(a)   With reference to the data in Table 1, explain the effect on the total revenue from leisure
       flights to UK destinations of
       (i)   a fall in price.   [2]
       (ii)   a fall in income.   [2]

(b)   Explain **one** possible reason for each of the following.
       (i)   why the demand for leisure flights to non-UK destinations is less price-elastic   [2]
              than that for UK destinations.
       (ii)   why the income elasticity of demand for business flights to UK destinations is   [2]
              higher than that for non-UK destinations.

(c)   Explain the likely value of the cross-elasticity of demand between high-speed rail travel   [2]
       and air travel.

(d)   Explain **either** one demand **or** one supply factor that has led to a rise in VFR travel.   [2]

(e)   With reference to the data where appropriate, and using economic analysis, discuss the   [8]
       effects of globalisation and improved technology on the market for air travel.

Question 3 (Optional)

Extract 1: Thailand's rice pledging scheme

Prime Minister Yingluck Shinawatra launched a gambit to shift more cash into the rural economy by buying up rice from farmers at about 18,000 baht or $550, a tonne - around 50% higher than the market rate. Ms. Yingluck and her advisers also reckoned they could drive up global rice prices by storing the grain they bought from farmers in vast warehouses, withholding it from the global market. But the timing of the government's rice program could scarcely have been worse. Just as Thailand began withholding rice from the international market, India resumed exports in 2011 after a long absence.

Rice pledging has decreased the competitiveness of Thai rice producers. One easy measure of competitiveness is market share, in which Thailand lost a lot because the government failed to sell the rice. In terms of input costs, the Thailand Development Research Institute reveals that both fertiliser prices and farmland rental rates increased after the rice-pledging scheme was implemented while productivity remained the same. Labour costs also rose due to a 40-90% increase in the minimum wage.

The attempt to set global rice prices has stripped the country of its position as the world's top exporter, left its prime minister facing a potentially ruinous investigation into the management of the plan, and thrown thousands of farmers into a deep hole of debt. The scale of loss to the government is massive. There is debate over how much loss the scheme incurred a year, ranging from 150 to 200 billion baht - equivalent to about 6-8% of the government's current budget. Under the most recent rice-pledging scheme the government still owes the one million farmers nationwide an amount totaling 140 billion baht because it failed to sell the rice.

There were opportunities when the government could have cleared rice stocks but it kept on speculating for a higher price. Thailand used to export 11 million tonnes of rice per year (roughly one million tonnes per month) and it is not clear if the government is even operationally capable of selling that much rice per month. Now the government is left with a huge supply of old rice of questionable quality.

Source: Asian Correspondent, 10 Feb 2014

Extract 2: Are Super Farms the Solution to the World's Food Insecurity Challenge?

As the global population approaches 9 billion by 2050, demand for food will keep increasing, requiring sustained improvement in agricultural productivity. Where will these productivity increases come from?

Advocates of large-scale agriculture point to its advantages in leveraging huge investments and innovative technologies. So, is large-scale farming - particularly the popularly known "super farms" - the solution to food demand challenges?

What is a super farm? There is no widely accepted definition of the minimum area that a farm must have to be considered a "super" farm. Some studies use 500 hectares while others use 10,000-15,000 hectares as the threshold for large-scale agriculture. These super farms often have large scale of operations, large investment flows, and an unambiguous profit orientation. They can potentially provide multiple benefits. Acquiring and processing information and technology is cheaper for large farms and gaining safety, environmental, and/or product identity certification is easier. They can also access international capital markets and conduct their own private research and development.

Source: World Bank Voices – Perspectives on Development, 26 Nov 2013

Extract 3: Trends in global rice consumption

Rice is a staple for nearly half of the world's seven billion people. However, more than 90% of this rice is consumed in Asia, where it is a staple for a majority of the population.

Since the early 1990s, strong economic growth in many Asian countries, particularly in China and India, halted the upward trend in global per capita rice consumption as consumers diversified their diet from rice to high-value products such as meat, dairy products, fruits, and vegetables. Per capita rice consumption is also on a downward trend in Thailand, Vietnam, and Malaysia.

In other countries such as Bangladesh and the Philippines, per capita consumption continues to rise across income groups in both urban and rural areas. Even high-income groups are found to consume more rice with a rise in income. National representative household consumption survey data collected between 2000 and 2010 from both countries confirm the trend.

Source: International Rice Research Institute, 2013

Table 1: Export Prices for Rice (US$/tonne)

Year	Grades of Rice			Thai A1 Super	Thai fragrant
	Thai (Grade 25%)	India (Grade 25%)	Vietnam (Grade 25%)		
2009	460	-*	384	329	954
2010	444	-**	387	386	1,045
2011	511	409	467	464	1,054
2012	560	391	397	540	1,091
2013	377	373	380	509	1,180

not available
not export
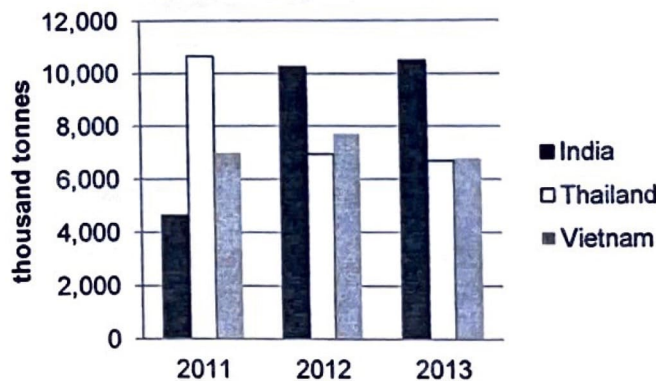
*Export price as India did

rice in 2009 and 2010
**rice pledging scheme in Thailand implemented from October 2011

Figure 1: Major Rice Exporters

Questions

(a)   Compare the trend in the price of rice from Thailand (grade 25%) and rice from India (grade 25%) between 2011 and 2013.   [2]

(b)   To what extent will restricting the supply of rice exports increase Thailand's export revenue from rice?   [8]

(c)   You have been appointed as Thailand's new economic advisor.

Discuss whether there is a better alternative to the rice pledging scheme.   [10]

[20 marks]

Section D: Essay Questions

1. Explain how the price mechanism allocates scarce resources in a free market. [10]

2. Milk prices that were at record-high levels in 2014 have abruptly plunged this year. Economic slowdown in China, the abolition of EU dairy-production quotas and record low prices of cattle feed are some of the factors that account for the low milk prices.

    (a) Explain the likely impact of the abovementioned factors on milk farmers' revenue. [10]

    (b) Evaluate the impact of the falling milk prices on two related markets. [15]

3. Grab is a transportation network company based in Singapore. In addition to transportation service, Grab launched its food delivery service, GrabFood, in Singapore in May 2018.

    (a) Using the marginalist principle, explain what Grab should consider when allocating resources to developing new services like GrabFood. [10]

    (b) Discuss the usefulness of elasticity of demand concepts to Grab. [15]

4. Falling interest rates, continued income growth and other factors contributed to a period of rapid residential property price inflation in Singapore from the middle of 2009. However, the government has successfully pursued policies to restrict this rise to the extent that residential property prices actually fell in 2014 and 2015.

    (a) Use supply and demand analysis to explain why falling interest rates and continued income growth may have led to a rapid rise in residential property prices. [10]

    (b) Discuss the policies that might be used by the Singapore government to reduce residential property price inflation. [15]

Optional Questions

1. In 2022, the Singapore government plans to raise the rate of Goods and Services Tax (GST) from 7% to 9%. GDP is forecasted to rise in 2022 by 5.5%.

    Adapted from: Business Times 3 Jan 2022

    (a) Explain the likely effect of this change in GST on expenditure by consumers on different types of goods. [10]

    (b) Discuss whether the combined effect of the rise in incomes and the rise in GST is likely to cause the quantities of different types of goods sold to rise or fall. [15]

2. A firm in Singapore is facing an increase in demand for its goods which has led to an increased demand for labour. Its demand for labour is also inelastic. In addition, large numbers of its workers born in the 1960s ('baby boomers') have been retiring, reducing the number of workers available to the firm.

    (a) With the aid of a diagram, explain how this firms' total expenditure on its workforce will have changed as a result. [10]

    (b) Discuss whether making changes to the foreign worker levy is likely to be the most effective way the Singapore government can address the labour shortages experienced by such firms. [15]

Section E: Further Reading

Article 1: Indonesia relaxes export ban to allow 37 coal vessels to depart	
Article 2: Indonesia's coal export backflip reinforces China's Australia ban	
Article 3: Factories hit by pandemic-related supply disruptions	
Article 4: OPEC vs. the US: Who Controls Oil Prices?	
Article 5: Caffeine hit: The rise and rise of Irish coffee culture	
Article 6: Tobacco tax hike will see prices of cigarettes go up by about $1 but experts say smokers may still be undeterred	