



RAFFLES INSTITUTION

YEAR 5 H2 ECONOMICS 2025

PRICE MECHANISM AND ITS APPLICATIONS

ECONOMICS

CONTENTS:

LECTURE NOTES

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This series of lectures provides an insight into the workings of the price mechanism in a perfectly competitive market. It focuses on the use of the demand-supply framework and elasticity concepts to analyse product and factor markets such as primary products, manufactured products, and the labour market. It also discusses the role of the price mechanism in the efficient allocation of resources.

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YEAR 5 H2 ECONOMICS 2025**

PRICE MECHANISM AND ITS APPLICATIONS (PART 1)

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Lecture Objectives:

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

- Explain how the price mechanism allocates resources in a free market
- Identify the determinants of demand and supply, and explain how they influence demand and supply
- Explain and analyse how prices are determined by free market forces of demand and supply
- Explain how changes in demand and/or supply may cause a market to be in disequilibrium and how prices adjust to restore equilibrium (i.e. price adjustment process)
- Apply demand and supply analysis in various markets

1. MARKET ECONOMY

1.1 The Market System

In the free market system (free of government intervention), resources are allocated according to the market forces of demand and supply. It is the level of demand and supply of each factor of production or final good/service that determines their respective prices and quantities traded.

Households are consumers of final goods/services, and their consumption decisions give rise to the market forces of demand. Firms are producers of goods/services, and their production decisions give rise to the market forces of supply. The coming together of buyers and sellers to transact goods/services is known as a market. In a free market system, resources are allocated according to the market forces of demand and supply.

The following characteristics are necessary for the market-based economy to allocate resources efficiently:

- **Perfect Competition**

Perfect competition is an essential feature of the free market economy. In perfect competition for each type of good/service, there are many buyers and sellers, each having an insignificant share of the market. No single buyer or seller is strong enough to control a market and exploit other sellers or buyers.

- **Rational Behaviour and the Pursuit of self-interest**

Consumers and producers are assumed to behave rationally. Economic activity in the free-market system is driven by **self-interest**. Producers or firms try to maximise profits, while consumers try to maximise utility.

- **Freedom of choice and enterprise**

All decisions are made by households and firms. Consumers are free to decide what to buy with their incomes. This is known as **consumer sovereignty**. Firms are free to choose what to sell and what production methods to use.

- **Private ownership of property**

Individuals have the right to own, control and dispose of land, capital and natural resources. Owners of factors of production have the right to the income (in the form of rent, interest and profits) earned from the use of these factors of production.

Question:

Does this happen commonly in the real world? Which market most closely resembles this?

Note:

There is consumer sovereignty when they influence the production decisions of the economy.

1.2 The Price Mechanism

The price mechanism operates in market economies where **changes in prices** (resulting from changes in demand or supply) will cause resources to move in or out of industries. According to Adam Smith (1776) *The Wealth of Nations*, the price mechanism is the **invisible hand** that allocates resources, based on the self-interest of consumers and producers, to result in the right mix of goods and services for society.

Guided by self-interest, households and firms interact in markets to eventually determine **what and how much to produce, how to produce and for whom to produce**.

Recall from The Central Problem of Economics:

What are the 3 different types of economic systems?

What are the 3 fundamental questions of resource allocation?

3 main functions of prices in the free market:

- **The signalling (allocative) function**

As signals, prices communicate information to decision-makers. Rising prices give a signal to consumers to cut back on the buying or even withdraw from a market completely. However, the higher price gives a signal to potential producers to enter a market. Resources move or re-allocate to different industries due to this signalling function. The signalling function is associated with changes in demand and supply.

- **The rationing (distributive) function**

Prices will ration the good/resource to consumers/producers who are willing and able to pay for it. Whenever there is a shortage, the market price will increase and the effect is to discourage consumption and conserve resources. Consumers or producers who are not willing and/or unable to pay for the good/resource will be rationed out of the market.

- **The incentive function**

An incentive is something that motivates a consumer or producer to change his behaviour. Higher market prices of a good motivate existing producers to increase output due to the possibility of more revenue and higher profits (assuming firms maximise profits) while a fall in price of a good provides an incentive to consumers to increase their quantity of the good demanded as they seek to maximise their utility.

In performing these functions, the price mechanism seeks to address the resource allocation questions of **what and how much to produce**, **how to produce** and **for whom to produce**.

The **what and how much to produce** under resource allocation question is answered when firms produce only those goods consumers are willing and able to buy, while consumers buy only those goods producers are willing and able to supply.

The **how to produce** under resource allocation question is answered because for given resource prices, firms will use the best combination of resources to produce a given output at the lowest possible average cost.

As consumers' dollar votes determine what is actually produced, it will also determine what consumers can actually buy. Those with more money will be able to consume more of the goods produced and this answers the '**for whom to produce**' question of resource allocation under the price mechanism.

1.3 An Overview of Demand-Supply Model

Market Equilibrium

Market equilibrium refers to a situation in which buyers and sellers are on aggregate satisfied with the current combination of price and quantity of a good bought or sold and there is no inherent tendency for price to change unless the equilibrium is disturbed.

In theory, assuming that markets are perfectly competitive and free from government intervention, prices and quantities will always tend toward an equilibrium price and quantity as determined by the price mechanism.

Equilibrium Price and Output

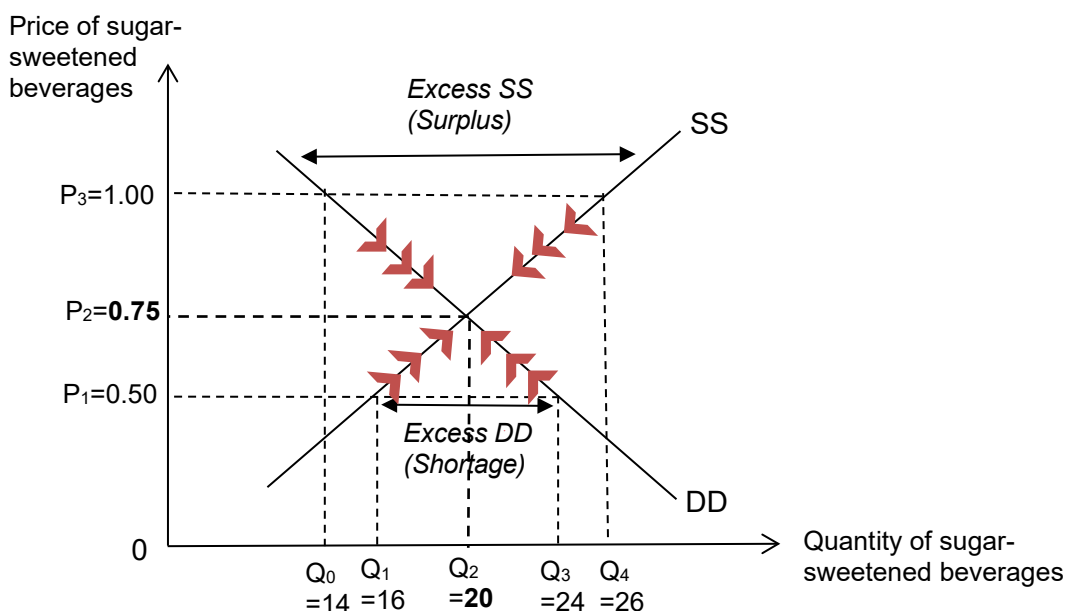
- Market equilibrium occurs at the price at which the **quantity demanded by consumers is equal to the quantity supplied by producers**, i.e., the price at which the equilibrium quantity is traded.
- Equilibrium price can therefore be referred to as the **market clearing price**.
- At any other price other than the market clearing price, quantity demanded and quantity supplied are not the same and the market is said to be in **disequilibrium**. There will be shortages (when $Q_d > Q_s$) or surpluses (when $Q_s > Q_d$) in the market which will trigger the adjustment process to cause price and quantity to adjust until a new equilibrium is attained.

Let us illustrate the idea of equilibrium price by looking at the table below:

Table 1: Demand and supply schedules for sugar-sweetened beverages

Price (\$)	Quantity Demanded	Quantity Supplied	Surplus or Shortage	Price will...
1.00	14	26	Surplus	fall
0.75	20	20	None	remain unchanged
0.50	24	16	Shortage	rise

Figure 1: Market for sugar-sweetened beverages



Market Adjustment Process:

If the price is above the equilibrium price (e.g. \$1.00), there is a **surplus** ($Q_0 > Q_4$) in the market as quantity supplied exceeds quantity demanded ($Q_s > Q_d$), resulting in a **downward pressure on prices** as producers lower the selling price to get rid of the excess stock. As price falls, consumers are more willing and able to buy sugar-sweetened beverages because their real income has increased and substitutes like non-sugar sweetened beverages have become relatively more expensive, causing quantity demanded to increase from OQ_0 to OQ_2 units. At the same time, profit-maximising producers will be incentivised to produce less because $Q_2 < Q_4$ units are no longer profitable, causing quantity supplied to decrease from OQ_4 to OQ_2 units. This fall in price continues until the equilibrium price of \$0.75 is reached. At this price, **quantity demanded equals to quantity supplied** and the equilibrium quantity is achieved at 20 units (OQ_2 units).

Refer to Section 2 and 3 for demand and supply theory.

If the price is below the equilibrium price (e.g. \$0.50), there is a **shortage** in the market as quantity demanded exceeds quantity supplied ($Q_d > Q_s$), resulting in an **upward pressure on prices** as consumers will try to outbid one another for existing supplies. As price increases, producers will be incentivised to produce more due to an increase in profitability, causing quantity supplied to increase. At the same time, some consumers will be less willing and able to buy sugar-sweetened beverages, causing quantity demanded to fall. This increase in price continues until the equilibrium price of \$0.75 is reached. At this price, **quantity demanded is equal to quantity supplied** and the equilibrium quantity is achieved at 20 units.

Sectional Summary

- In the free market economy, price mechanism determines what and how much to produce, how to produce and for whom to produce,
- Market equilibrium occurs when quantity demanded is equal to quantity supplied at the same price. At the equilibrium price and quantity, there is no tendency to change.
- Markets are in disequilibrium when there is a shortage or a surplus. A shortage creates upward pressure on price, while a surplus creates downward pressure on price.

2. DEMAND THEORY

2.1 Demand

The demand for a commodity refers to the amount that consumers are **willing** and **able** to purchase at each given price over a given period of time. For demand to be effective (thus also called 'effective demand'), willingness to pay must be supported by the ability to pay.

2.2 The Law of Demand

Consumers will typically be more willing and able to buy more of a good or service when price falls and conversely, buy less of a good or service when price increases.

The Law of Demand states that the **quantity demanded** of a good/service is **inversely related** to its **price**, *ceteris paribus*.

To explain the inverse relationship between price and quantity demanded, we need to understand the concepts of:

(i) Law of Diminishing Marginal Utility

Table 2: Consumer A's total and marginal utility from consuming good X

Quantity of Good X	Total Utility (\$)	Marginal Utility (\$)
1	10	10
2	18	8
3	24	6

With reference to table 2, Consumer A derives \$10 equivalent of utility from consuming the 1st unit of good X, \$8 equivalent of utility from consuming the 2nd unit of good X, and \$6 equivalent of utility from consuming the 3rd unit of good X.

Notice that as more units of the good is consumed, the marginal (or additional) utility derived from consuming an additional unit of the good decreases. This phenomenon is known as the **Law of Diminishing Marginal Utility (LDMU)**.

Recall:

LDMU states that beyond a certain point of consumption, each extra unit consumed gives less additional utility than previous units.

(ii) Consumers' decision on how much to consume (using marginalist principle)

As a **rational consumer** seeking to **maximise total utility given a budget constraint** (that is to maximise total net utility), consumer A will apply the **Marginalist Principle** in deciding how many units of the good to purchase.

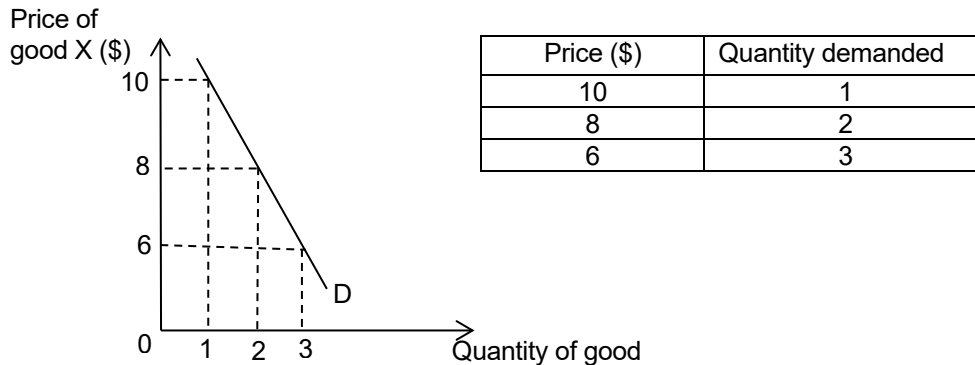
- **If the marginal utility for the unit is more than its price ($MU > P$)**, consumer A will purchase that unit of good X as doing so makes consumer A better-off since the additional utility derived from consuming the additional unit exceeds the amount spent on that unit. Buying this additional unit will increase total net utility.
- **Consumer A will continue to purchase additional units of the good up to the point when marginal utility is equal to the price ($MU = P$)** as the additional utility derived from consuming the additional unit of the good will be equal to the amount spent and there will be no change in total net utility.
- **If the marginal utility is less than its price ($MU < P$)**, consumer A will not purchase an additional unit of good X as doing so makes consumer A worse-off since the amount spent exceeds the additional utility derived from consuming it. Buying this additional unit will lead to a fall in total net utility.

Applying the Marginalist Principle to this example:

- If $P=\$10$, consumer A will purchase up to 1 unit of good X.
- If $P=\$8$, consumer A will purchase up to 2 units of good X.
- If $P=\$6$, consumer A will purchase up to 3 units of good X.

In summary, a consumer experiences diminishing marginal utility in consuming additional units of good X. In maximising total utility with a given budget (or total net utility), the rational consumer will increase the quantity demanded as price decreases, and vice versa. This gives rise to a **downward sloping individual demand curve**.

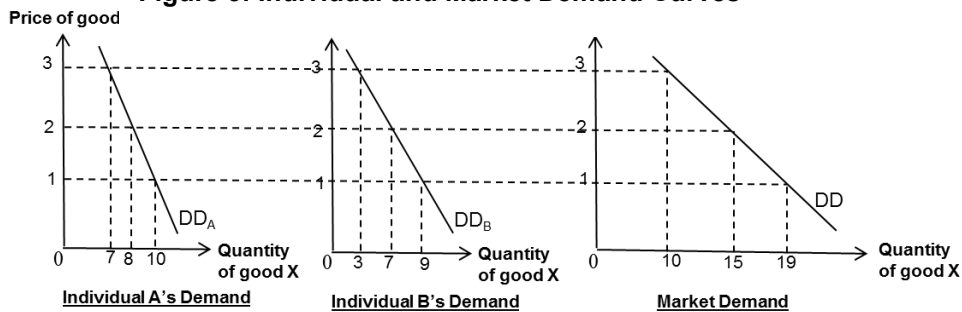
Figure 2: Consumer A's Demand for good X



Market Demand Curve

The market demand curve is the **horizontal summation** of all the individual demand curves.

Figure 3: Individual and Market Demand Curves



The market demand curve is downward sloping due to the Law of Demand. There are two reasons for this law:

• Substitution effect

It is the effect of a change in the price of the good on its quantity demanded arising from the consumer switching to, or from, alternative products because the **relative price of the alternative products have changed**, *ceteris paribus*. For example, an increase in the price of strawberries leads to consumers switching to a **relatively cheaper** substitute (e.g. grapes) and buying less strawberries.

• Income effect

The income effect occurs when a change in the price of the good affects consumers' real income or purchasing power which in turn affects consumers' ability to buy the good. For example, a rise in the price of strawberries, *ceteris paribus*, will mean that

consumers can now purchase less units of the good with the same level of income. Thus, real income falls and consumers' ability and willingness to buy strawberries will fall and hence, quantity demanded falls.

2.3 Movement along vs shift of the demand curve

It is important to distinguish between a movement along vs shift in the demand curve:

2.3.1 Movement along the demand curve represent **changes in quantity demanded** arising from a change in price of the good itself, ceteris paribus. In this case, the assumption of ceteris paribus implies that none of the determinants of demand changes other than the price of the good.

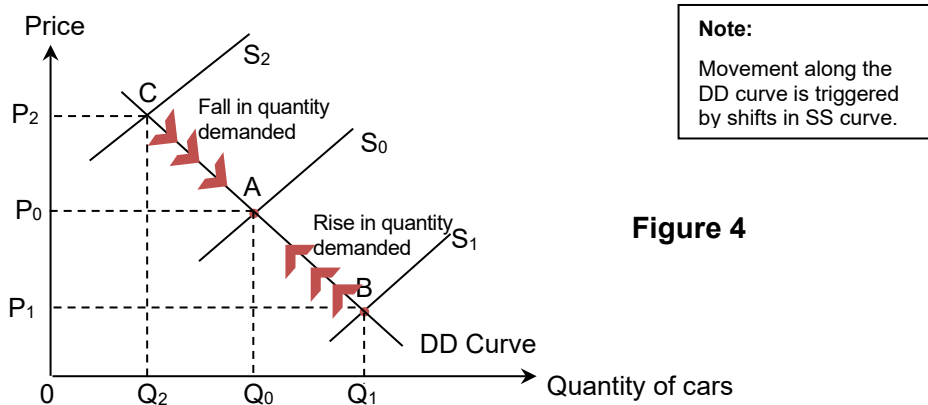


Figure 4

2.3.2 Shifts of the demand curve represent **changes in non-price determinants of demand**, assuming no change in the price of the good itself.

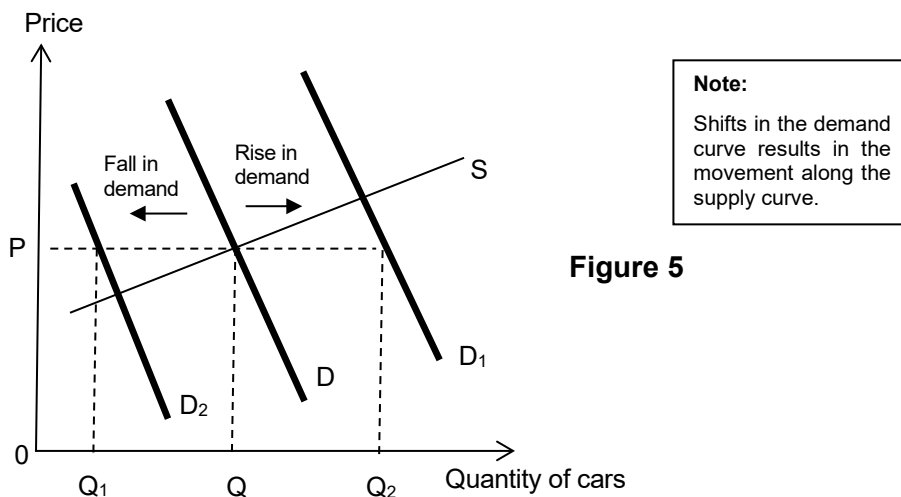


Figure 5

With reference to Figure 5 above, an increase in demand i.e. increase in quantity demanded at every price level is represented by a rightward shift of the entire demand curve from D to D1. Similarly, a fall in demand i.e. fall in quantity demanded at every price level is represented by a leftward shift of the entire demand curve from D to D2.

Summary

- A movement along the demand curve due to a change in price of the good itself is referred to as a change in the quantity demanded.
- A shift in the demand curve due to a change in non-price determinants is referred to as a change in demand.

2.4 Factors shifting the market demand curve

Non-price determinants of demand include:

Tastes and Preferences

Income

Government Policies

Expectations of future price changes

Prices of Related Goods

Population size or structure

Interest rates

Exchange rates



a. Changes in Tastes and Preferences

Taste is significant in influencing consumers' desired purchases and hence their willingness to purchase a good.

Factors affecting taste include the effects of advertisements, education, culture and age group. A change in taste towards a particular good is likely to increase the demand for that good and will cause the demand curve to shift to the right, vice versa.

For example, temporary increases in demand for merchandise can occur due to fads, latest craze like K-pop and Korean dramas. Similarly, there have been permanent decreases in demand for CD players as a result of new inventions, new improved products like iPods and iPads.

Question:

To what extent do you think consumers today are affected by advertisements?

Do consumers really make their own decisions, or are we "controlled" by subliminal messaging?

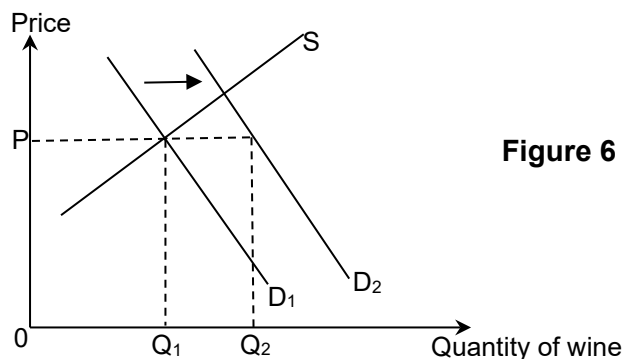


Figure 6

As seen in Figure 6 above, suppose that the original demand curve for wine is given by D_1 . If the given price is OP , then the demand curve D_1 indicates that quantity OQ_1 will be demanded.

Suppose there is a discovery by the British Medical Association that people who regularly drink wine live longer, healthier lives. This discovery would then influence consumers' taste and preference and **raise the demand** for wine. Consumers are now more willing to purchase a greater quantity of wine at every price. The **demand curve shifts rightwards** from D_1 to D_2 . At the same price OP , quantity demanded increases from OQ_1 to OQ_2 .

Seasonal changes / Climatic changes (a sub-set of tastes & preferences)

For example, during the hot season, the demand for air conditioners and fans increases. The hot weather increases the consumers' willingness to purchase more air conditioners and fans in order to keep cool, causing the demand curve to shift to the right. On the other hand, during winter, the demand for winter clothes would increase.

Question:

What other examples can you think of?

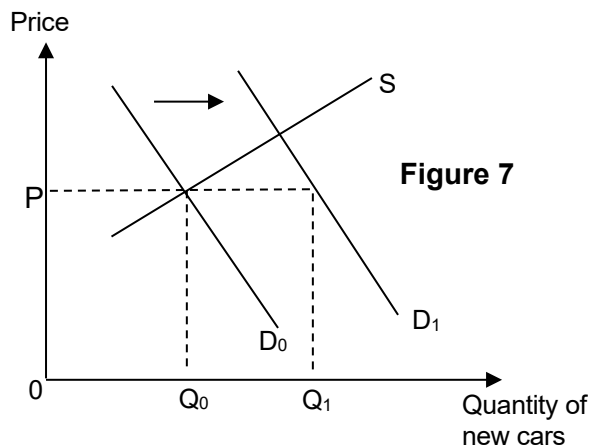
Festivals can also play a part. For example, just before Chinese New Year and Hari Raya, the demand for eggs, flour and new clothes increases. Similarly, Valentine's Day will see an increase in demand for flowers, chocolates, and restaurant meals.

b. Changes in Income levels

Changes in consumers' incomes will affect the consumers' **ability to purchase goods and services**. An increase in income means that consumers have more to spend in total and this increases their ability to purchase more goods and services. This will lead to re-adjustments of consumers' expenditure patterns, which increases demand for some goods and decreases demand for other goods depending on whether the goods are normal goods or inferior goods.

A good is a **normal good** when the demand for it increases in response to an increase in consumer income and vice versa i.e. **demand for the good varies directly with income**. Most goods are normal goods. An increase in income leads to a rise in demand hence shifting the demand curve to the right.

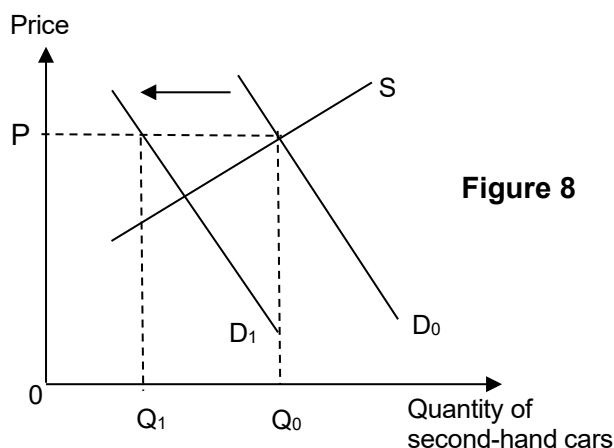
An **inferior good** is one where the demand will fall as consumers' incomes increase and vice versa i.e. **demand for the good is negatively related to income**. They are often regarded as cheap but inferior substitutes for other goods. Examples of inferior goods are second-hand clothes, second-hand cars. As incomes increase, consumers experiencing an increase in their ability to buy, tend to switch to more expensive and better quality substitutes (new clothes, branded clothes, new cars). This results in a decrease in the demand for inferior goods.



Market for new cars (normal goods)

An increase in income will increase the consumers' ability to buy new cars, thus increasing the quantity demanded for new cars at every price level, i.e. increasing in the demand for new cars.

As shown in Figure 7, the demand curve for new cars will shift to the right from D_0 to D_1 .



Market for second-hand cars (inferior goods)

As consumers' ability to buy new cars increases with increases in their income, consumers will tend to switch away from purchasing second-hand cars causing a decrease in the demand for second-hand cars.

With reference to Figure 8, the demand curve will shift to the left from D_0 to D_1 .

c. Changes in Government Policies

i. Direct Tax Policy

Direct tax is a tax on people's incomes. Changes in direct tax rates affect people's **disposable income** (income available for spending after payment of income tax). An increase in the income tax rate will reduce people's disposable income. This in turn reduces their ability to pay, leading to a decrease in demand for normal goods and services, and vice versa.

Question:

What is the income tax rate for different income brackets in Singapore?

ii. Direct Subsidy Policy

Direct subsidies are payments made by the government to the consumers. For example, housing grants for married couples who stay near their parents, Edusave grants for primary to junior college students.

Question:

What other examples can you think of?

Such direct subsidies increase the consumers' ability to pay and hence demand. For instance, the housing grants encourage married couples to stay near their parents and result in an increase in demand for housing in areas near to where their parents are staying.

d. Expectations of future prices

Another factor influencing the demand for goods is consumers' expectations of future prices of the goods. If consumers expect prices of the good (e.g. gold) to rise in the future, *ceteris paribus*, they would demand for more gold now, leading to a rightward shift of the demand curve. Conversely, if consumers expect the price of gold to fall in the future, they will postpone consumption of gold now, leading to decrease in demand for gold in the current period.

e. Changes in price of a related good (substitute and complement)

i. Changes in the price of substitutes

A **substitute** is a commodity that can be used in place of another. It satisfies the same want. Substitute goods are thus in **competitive** demand, e.g. butter & margarine, Coca-Cola & Pepsi, MRT & taxi services, Cadbury and Nestle chocolates. If two goods are substitutes, then an increase in the price of one good will lead to a rise in the demand for the substitute.

Question:

What other examples can you think of?

For example, suppose there is a rise price of butter due to a rise in the cost of production causing a fall in supply for butter as represented by a leftward shift of the supply curve from S_0 to S_1 . Since butter is now relatively more expensive as compared to margarine, consumers will now switch away from butter to consuming margarine instead. Hence, the demand for margarine increases as represented by a rightward shift of the demand curve from D_0 to D_1 .

Refer to Section 3 on determinants of supply.

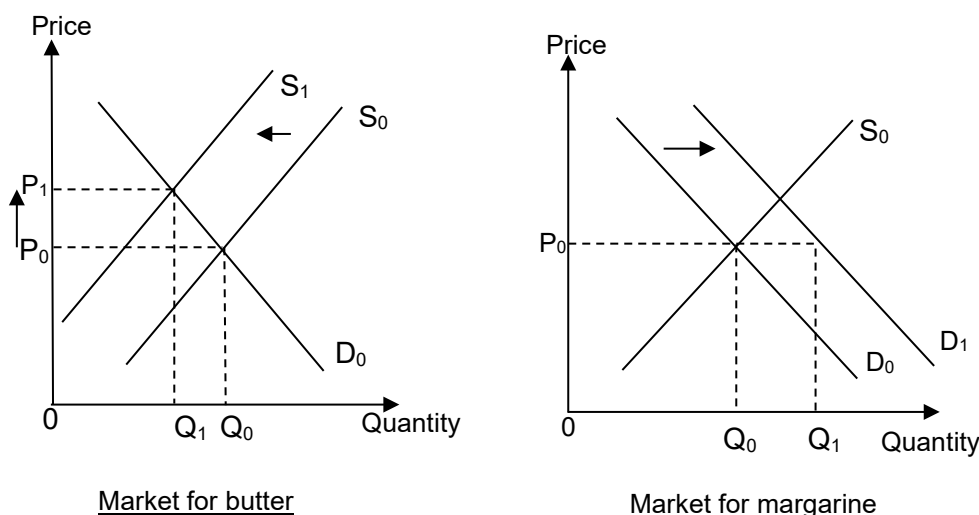
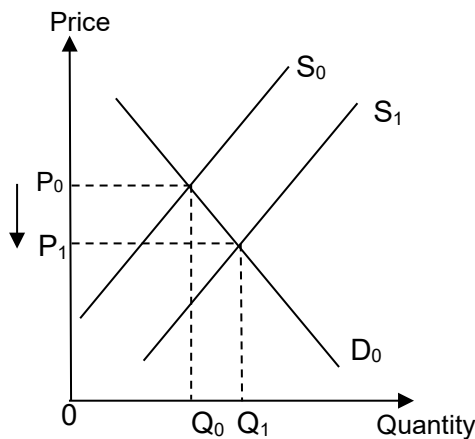


Figure 9

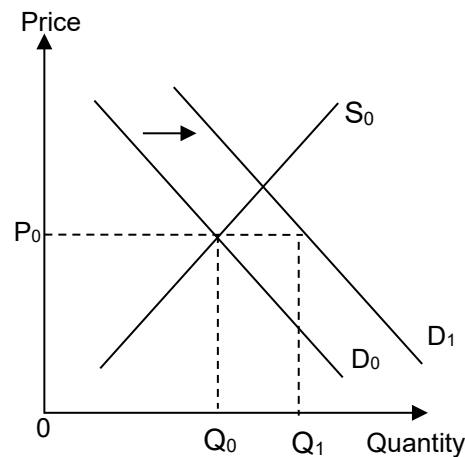
ii. Changes in the price of Complements

A complement is a good that is used in conjunction with another to satisfy the same want. Complements are thus in **joint demand**, e.g. car and petrol, digital camera and memory card, blue ray DVDs and blue ray DVD players, computers and computer software, etc. For two goods that are complements of each other, a fall in the price of one good will lead to a rise in the demand for the other good, and vice versa.

For example, suppose there is a fall in the cost of producing cars due to technological advancement leading to a rise in the supply for cars (represented by rightward shift of SS curve from S_0 to S_1). Price of cars will fall from $0P_0$ to $0P_1$. With the decrease in price from $0P_0$ to $0P_1$, the quantity traded for cars increases from $0Q_0$ to $0Q_1$. As more cars are purchased and consumed, the demand for petrol (the complementary good) will increase. The demand curve for petrol shifts right from D_0 to D_1 .



Market for Cars



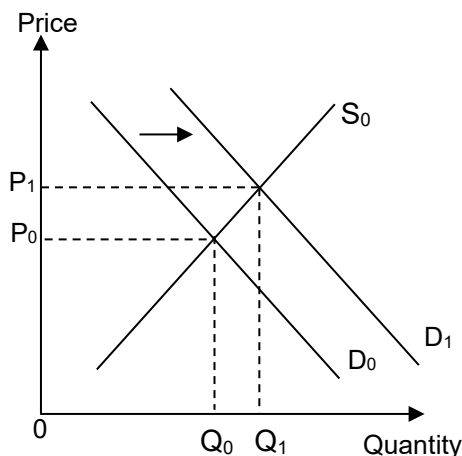
Market for Petrol

Figure 10

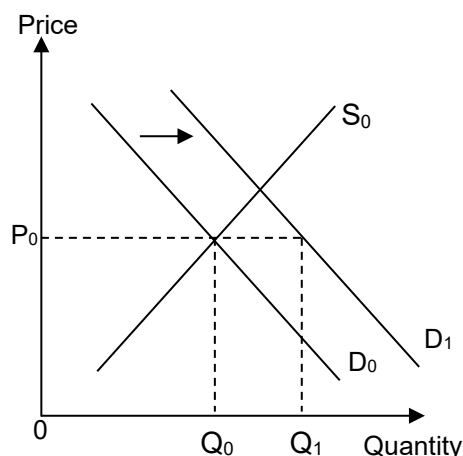
f. Changes in demand of related goods (factor of production)

Other than competitive and joint demand, there is also **derived demand**. Derived demand refers to demand for one good or service that occurs as a result of the demand for another intermediate/final good or service.

For example, the production of cars requires the use of steel. An increase in demand for cars will increase the revenue that firms can obtain from selling cars. Hence firms are more willing to buy more steel in order to increase their car production. As such, the demand for steel increases. The demand for steel is thus a derived demand. From Figure 11, the demand for cars and steel both increase from D_0 to D_1 .



Market for Cars



Market for Steel

Figure 11

Important:

Students often confuse complements with factors of production.

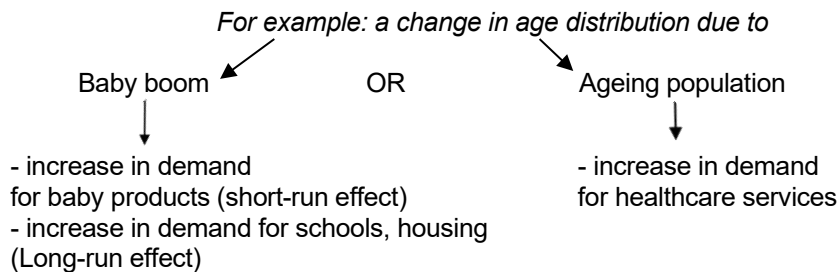
Go back to the definitions of these terms to clarify any confusion which may arise.

Complements are goods that are used in conjunction to fulfil a want, whereas factors of production are resources/intermediate goods used to produce a final good.

Another common analysis will be the market for labour since workers are needed to produce goods and services. Thus, the demand for labour is also a derived demand.

g. Changes in Population Size or structure

This affects the number of potential consumers or the size of the market. Changes in population can be due to an absolute increase or decrease in the total population or a change in the composition/demographics of the population.



h. Changes in interest rates

The rate of interest is the price of borrowing money. Changes in the rate of interest affect the level of demand by consumers, especially those who rely on loans or hire purchase. For example, an increase in the rate of interest will reduce the demand for cars and housing as the cost of purchase (in terms of monthly payments) increases even though the prices of cars and housing stay the same. The demand curve for these goods shifts leftwards.

Think:

Interest rates also affect savings. How would an increase in interest affect your savings?

i. Changes in Exchange rates

This refers to the rate at which a country's currency (e.g. S\$) exchanges for another currency (e.g. US\$). Changes in the rate of exchange will affect foreign demand for a country's goods and services.

If the S\$ appreciates (strengthens) against the US\$, ceteris paribus, Singapore goods which are sold to the USA (known as Singapore's exports) become more expensive in US\$. For instance, at an exchange rate of S\$1 = US\$0.70, a S\$100 export from Singapore will be sold in the US for US\$70. If the S\$ appreciates to S\$1 = US\$0.85, the same good will be sold for US\$85.

US consumers will turn away from Singapore exports and turn to relatively cheaper US domestic substitutes. This decreases the demand for Singapore exports and increases the demand for US goods.

Sectional Summary

- Demand for a good/service refers to the quantity of the good/service that consumers are willing and able to purchase at every given price over a given period of time.
- The demand curve is downward sloping as price and quantity demanded are inversely related.
 - The Law of Diminishing Marginal Utility influences the individual demand curve.
 - The Law of Demand influences the market demand curve.
- The list of non-price determinants of demand is not exhaustive and not all determinants are applicable to every market. The more significant determinants include tastes and preferences, income, and expectation of future prices.

3. SUPPLY THEORY

3.1 Definition of Supply

The supply of a good or service refers to the quantity of a good or service that producers are **willing** and **able** to offer for sale at each given price over a given period of time.

3.2 The Law of Supply

The quantity supplied is directly related to the price of a product. The higher the price of a good, the greater the quantity supplied and vice versa, **ceteris paribus**. Graphically, this is represented as a movement along the upward-sloping supply curve.

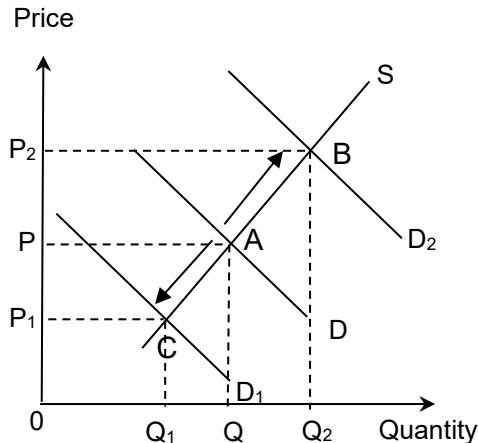
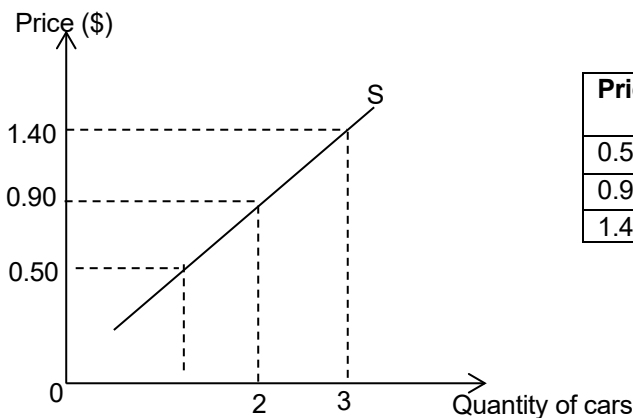


Figure 12

Note:
Movement along the supply curve is caused by shifts of the demand curve.

Supply Curve

The firm's supply curve is a graphical representation of the relationship between the price of a good and the quantity supplied by a firm over a given period of time, *ceteris paribus*. It shows the amount of a good that a producer is able and willing to make available for sale at each given price over a given period of time.



Price (\$)	Quantity supplied
0.50	1
0.90	2
1.40	3

Figure 13

The marginal cost that a producer incurs from producing an additional unit of a good is important in determining how much he is willing to accept for producing it. Referring to the above diagram:

- From Figure 13, producer A incurs \$0.50 from producing the 1st unit of good X, \$0.90 from producing the 2nd unit of good X, and \$1.40 from producing the 3rd unit of good X.

- The marginal cost of producing additional units of good X is increasing due to the Law of Diminishing Marginal Returns to output. A simple illustration will be the scenario where more and more workers are assigned to a single machine. Eventually as the machine becomes overutilized, productivity declines. With less additions to output, the additions to cost increases. This will be covered in detail in 'Production and Cost'.
- Being a rational producer seeking to maximise its profits, producer A will apply the Marginalist Principle in deciding how many units of good X to produce.

Recap:
LDMR states that beyond a certain point of production, adding an additional factor of production results in smaller increases in output. This essentially means an increase in marginal cost.

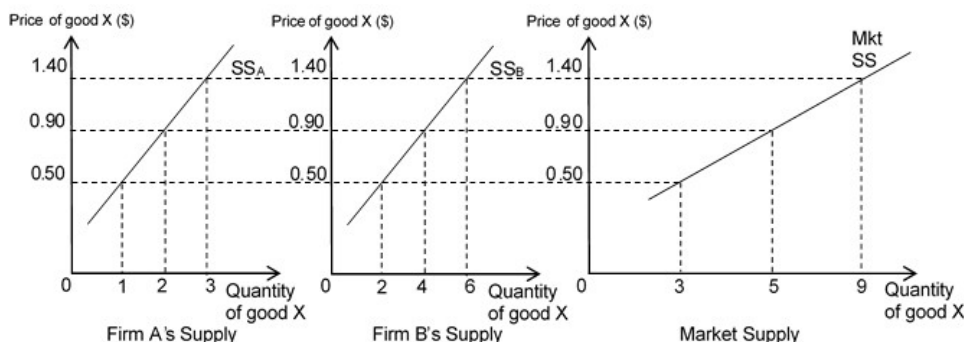
According to the Marginalist Principle:

- If the **price is more than its marginal cost of production ($P > MC$)**, producer A should produce that additional unit of good X as doing so increases profits and allows producer A to become better-off.
- **Producer A will continue to produce additional units of the good up to the point where the price is equal to the marginal cost of production ($P = MC$)** as any additional units of the good does not change profit levels.
- If the **price is less than the marginal cost of production ($P < MC$)**, producer A will not produce the additional unit of good X as doing so decreases profits and makes producer A worse-off.
- Applying the Marginalist Principle to this example:
 - If $P = \$0.50$, Producer A will produce up to 1 unit of good X.
 - If $P = \$0.90$, Producer A will produce up to 2 units of good X.
 - If $P = \$1.40$, Producer A will produce up to 3 units of good X.

In summary, a producer experiences diminishing marginal returns in producing additional units of good X. To maximise profits, the rational producer will increase output as price increases, and vice versa, giving rise to an **upward sloping firm supply curve**.

Market Supply Curve

The market supply is the **horizontal** summation of firms' supply curves as seen in Figure 14.



Question:

Are firms able to quantify their supply? Why or why not?

Figure 14

Summary

- The upward sloping firm's supply curve is explained by the Law of Diminishing Marginal Returns.
- The marginal costs incurred from the production of each additional unit of the good increases as quantity supplied increases. A higher price is required to incentivise firms to increase output and vice versa.

3.3 Movement along vs shift of the supply curve

It is important to distinguish between a movement along vs shift in the supply curve:

3.3.1 Movement along the supply curve represent **changes in quantity supplied** arising from a change in price of the good itself, ceteris paribus.

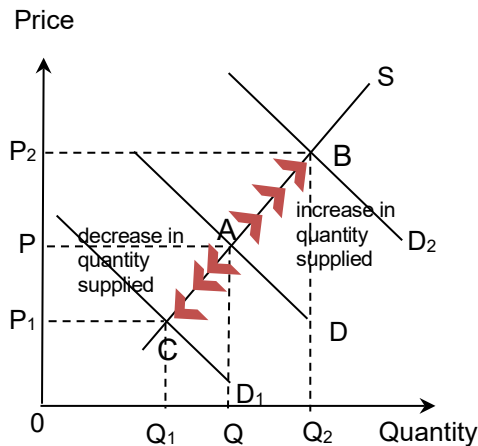


Figure 15

Note:
Movement along the supply curve is caused by shifts of the demand curve.

3.3.2 Shifts of the supply curve represent **changes in non-price determinants of supply**, assuming no change in the price of the good itself.

A change in the non-price determinants of supply changes the quantity that producers are willing and able to sell at every given price. Graphically, this is represented by a shift in the supply curve.

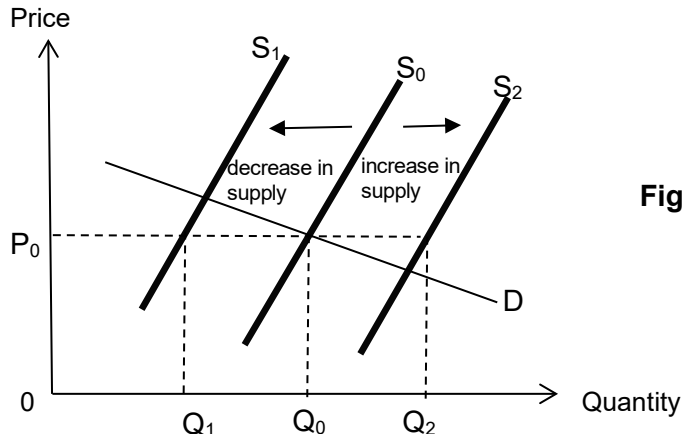


Figure 15

Note:
Shifts of supply curve causes movement along the demand curve.

Any change in non-price determinants of supply which lowers the quantity supplied by producers at every given price is a fall in market supply. This is represented by a leftward shift of the supply curve from S_0 to S_1 . Similarly, any change in non-price determinants of supply that increases the quantity supplied by producers at every given price is an increase in market supply. This is represented by a rightward shift of the supply curve from S_0 to S_2 .

Summary

- A movement along the supply curve due to a change in price of the good itself is referred to as a change in the quantity supplied.
- A shift in the supply curve due to a change in non-price determinants is referred to as a change in supply.

3.4 Factors shifting the market supply curve

Non-price factors of supply include:

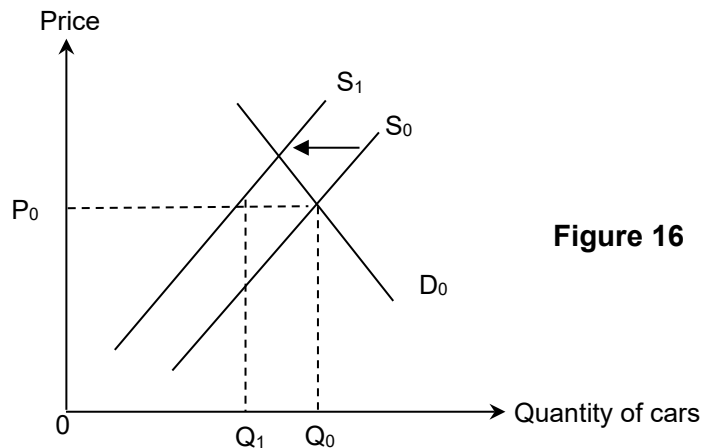
- **C**ost of Production (which is influenced by price and availability of **F**actor inputs, **I**nnovation/ state of technology and **G**overnment Policies)
- **R**elated goods' prices
- **E**xpectations of future price changes and **E**ntry/exit of firms
- **W**eather conditions and other natural factors

a) Changes in the Costs of Production

Cost of production can be influenced by:

(i) **Changes in the price and availability of factor inputs** such as raw materials, fuel and power, labour will change the cost of production causing changes in the level of profits and supply of the good.

For example, if the price of steel increases, the cost of producing cars will rise, causing production to be less profitable. Firms will be less willing and able to produce the good at each and every price level, causing supply curve to shift leftwards from S_0 to S_1 as shown in Figure 16.

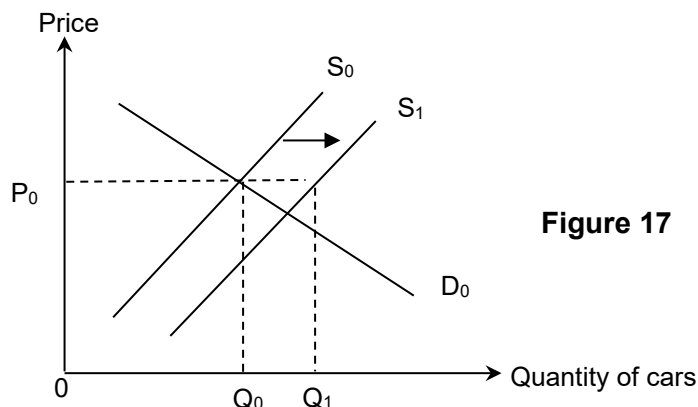


(ii) Innovation/ Changes in State of Technology

The state of technology represents the economy's stock of knowledge about how resources can be combined most efficiently. Improvements in the techniques of production, resulting from new inventions or technological advances, will **increase the productivity of the factors of production**. Each unit of a factor will be able to produce more now. With the same factor price, **cost per unit of output will be lower**. Producers are thus more willing and able to supply more of the good at every given price. This will increase the supply of the good and supply curve shifts right from S_0 to S_2 in Figure 17.

Is technology change and productivity change more likely to happen in the long run or the short run?

Definition:
Productivity is measured by output per unit of input.



(iii) Government Policies

Government policies on *indirect* taxation and subsidies has the effect of changing the cost of production and therefore the supply of a good. When there is an indirect tax levied, this has the effect of increasing the cost of production which in turn reduces profitability, causing sellers to be less able and willing to sell at every price, hence supply falls. When there is an indirect subsidy given, this has the effect of reducing cost of production, causing the supply to increase.

Think:

What other examples of indirect taxes/subsidies can you think of?

Indirect taxes are taxes imposed on expenditure of goods and services. An example is the Goods & Services Tax (GST). Such a tax is levied on the firms and added on to their cost of production. Since it has the effect of increasing cost of production and in turn reducing profitability, firms will be willing to sell/produce fewer units at every price, leading to a fall in supply.

Indirect subsidy is a payment made by the government to firms to produce a particular good. This has the effect of reducing the firms' cost of production which increases profitability and hence increases the firms' willingness and ability to sell/produce more goods at every price. Supply increases leading to a rightward shift of the supply curve.

b) Changes in Prices of Related Goods

(i) Joint Supply

Joint supply of two or more products refers to the production of goods that are **derived from a single product**. It is not possible to produce more of one without producing more of the other. This means that an increase in the price of one good leads to an increase in supply of the other joint product. For example, butter and skimmed milk are both produced from whole milk, petrol and diesel are produced from crude oil, beef and leather from cattle.

With reference to Figure 18, an increase in the demand for beef (demand curve shifts right from D_0 to D_1) will result in an increase in its price. Producers will be encouraged to increase quantity supplied to OQ_1 . The increase in quantity supplied of beef results in more leather being offered for sale on the market. Hence the supply of leather increases and the supply curve of leather shifts right from S_0 to S_1 . At the same price OP , quantity supplied increases from OQ_0 to OQ_1 .

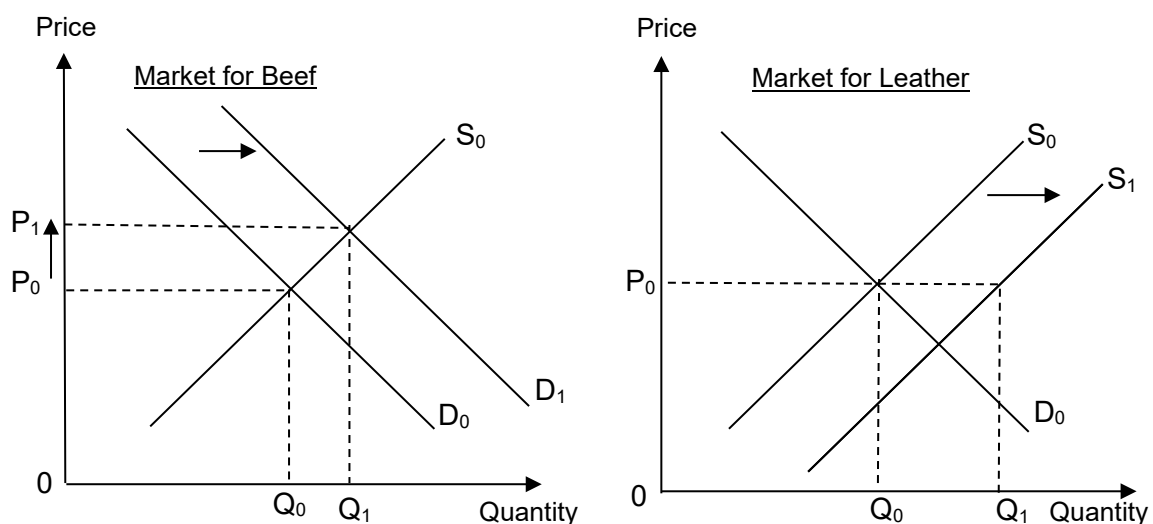


Figure 18

(ii) Competitive Supply

Competitive supply of two or more products refers to production of one **OR** the other by a firm. The goods **compete for the use of the same resources** and producing more of one means producing less of the other.

An example would be corn which can be used as food for consumption or for the production of biofuel. As seen in Figure 19, an increase in the demand for biofuel (demand curve shifts right from D_0 to D_1) causes the price of biofuel to increase from OP_0 to OP_1 , and farmers will choose to produce corn for biofuel production as this is more profitable. As a result, the supply of corn for consumption will decrease and the supply curve of corn as food shifts to the left from S_0 to S_1 .

Question:

What other examples can you think of?
Do you think this applies to the 4 factors of production such as land and labour?

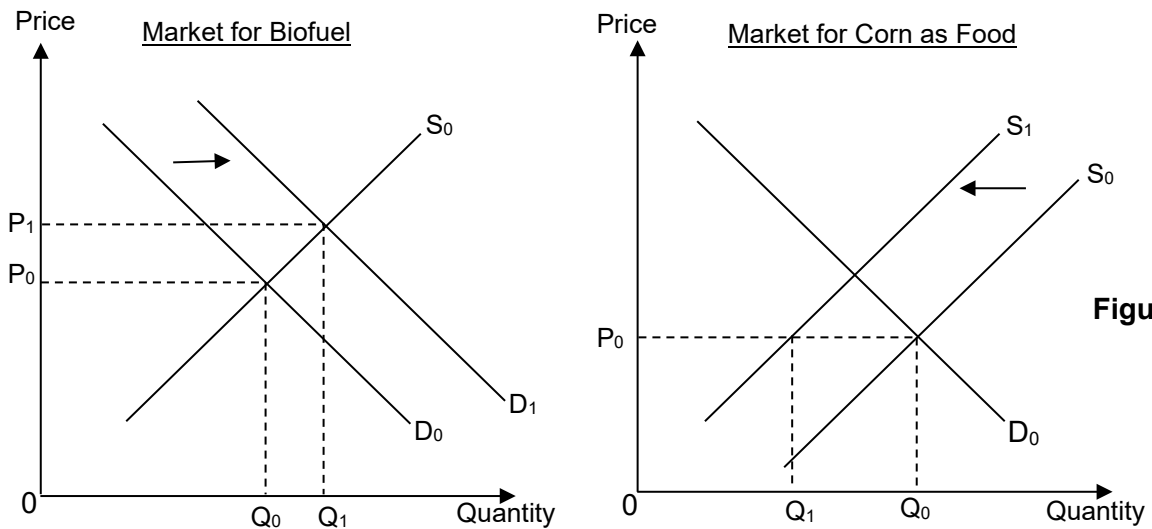


Figure 19

c) Expectations of future price changes and entry or exit of firms in the long run

If price is expected to rise, producers may temporarily reduce the amount they sell in the market. They are likely to build up stocks and only release them to the market when the price increases. At current prices, producers are willing to supply less than they otherwise would. This is represented by a leftward shift of the supply curve. The opposite would be true if producers expect prices to fall.

Think:

What other examples can you think of?

In the long run, the entry of new firms into a market increases the number of producers, leading to a rise in market supply. This is reflected by a rightward shift of the supply curve, as a higher quantity is supplied at every price. Conversely, exits of firms reduce supply, shifting the curve leftward.

Note:

The difference between short run and long run period will be explored in greater detail in the next topic "Firms and Decisions".

d) Weather conditions and other natural factors

Favourable climatic conditions such as abundant and reliable rainfall as well as absence of pests increase the supply of agricultural products. This will shift the supply curve to the right. Occurrence of natural disasters such as droughts, floods, earthquakes, severe haze will lead to a leftward shift in the supply curve.

Think:

How does this affect markets in Singapore?

Sectional Summary

- Supply of a good/service refers to the quantity of the good/service that producers are willing and able to offer for sale at every given price over a given period of time.
- The supply curve is upward sloping as price and quantity supplied is directly related according to the Law of Supply.

- There are many non-price determinants of supply. The more significant non-price determinants of supply include cost of production/prices of factors of production, innovation/state of technology, and government policies.

4. INTERACTION OF DEMAND AND SUPPLY

4.1 Effect of Demand Shifts on Equilibrium Price and Quantity

When **demand increases**, a **shortage** is created at the initial equilibrium price as the current equilibrium quantity would be insufficient and price adjusts upwards in order to reach a new equilibrium price and quantity.

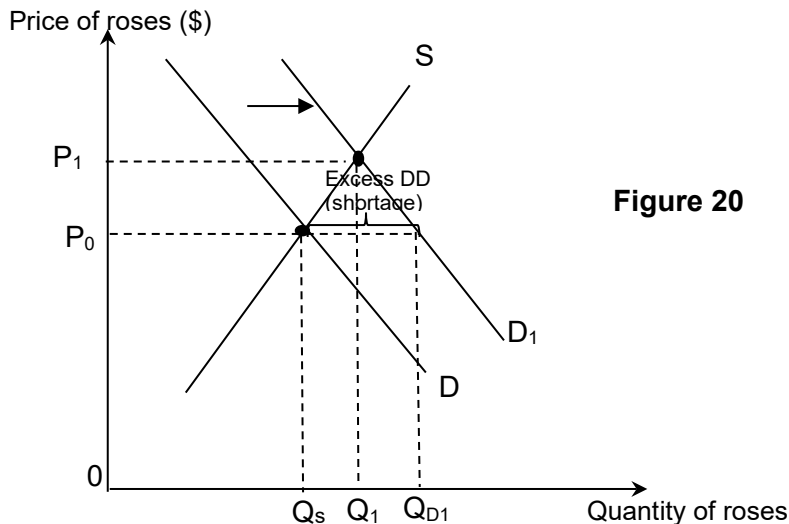


Figure 20

Strategy:
Use the 3-step analysis

1. Decide whether demand or supply is affected given the scenario.
2. Decide direction of shift in demand or supply curve and the demand / supply factor causing the change.
3. Explain how the market adjust to new equilibrium price and quantity given shifts in demand and supply curves.

For example, during Valentine's Day, there is greater willingness to buy roses as gifts for friends and loved ones, leading to an increase in seasonal demand for roses. With reference to Figure 20, demand curve shifts right from D to D_1 . At the original equilibrium of OP , there is a shortage $Q_{D1} - Q_s$ as quantity demanded (Q_{D1}) exceeds quantity supplied (Q_s). There will thus be an upward pressure exerted on the price as consumers try to outbid one another for the limited quantity of the good.

As the price rises, it becomes more profitable for profit-maximising firms to increase the amount of roses supplied, while utility-maximising consumers' ability and willingness to purchase roses fall due to the income and substitution effect. Quantity supplied increases while quantity demanded falls until the shortage is eliminated. The new equilibrium price is reached at OP_1 and equilibrium quantity increases to OQ_1 .

Conversely, if **demand falls**, a **surplus** is created at the initial equilibrium price causing price to adjust downwards until a new equilibrium price and quantity.

Let's Practise!

Are you able to explain the impact on equilibrium price and quantity when demand falls?

4.2 Effect of Supply Shifts on Equilibrium Price and Quantity

When **supply increases**, represented by a rightward shift in the supply curve, a **surplus** is created at the prevailing price, as quantity supplied is greater than the quantity demanded. To eliminate the surplus, firms reduce their price, exerting a downward pressure on the market price.

Tip:

It is important to learn the full explanation of the market adjustment process well, which include the explanation of the income and substitution effect.

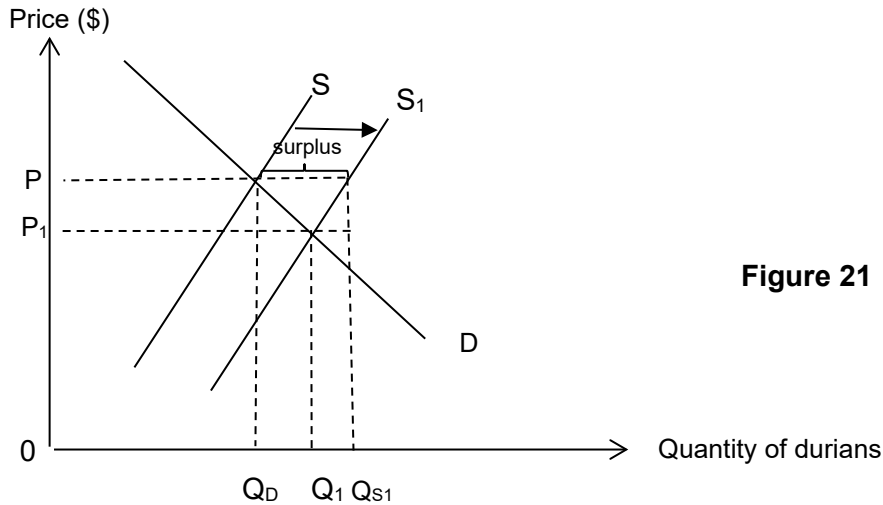


Figure 21

Suppose the harvest for durians increases due to favourable weather conditions in Malaysia. The supply of durians increases, leading to a rightward shift in the supply curve from S to S_1 as seen in Figure 21. With the increase of quantity supplied at every given price level, *ceteris paribus*, a surplus of $Q_{S1} - Q_D$ occurs at the original price OP as quantity supplied (Q_{S1}) exceeds quantity demanded (Q_D). This will cause a downward pressure on price as producers offer lower price to sell their surplus durians.

As the price begins to fall, more consumers are now willing and able to buy more durians due to the income and substitution effect. The quantity demanded would increase, while quantity supplied would decrease until the surplus is eliminated. The new equilibrium price falls to OP_1 and the new equilibrium quantity increases to OQ_1 .

Conversely, if **supply falls**, a **shortage** is created such that price adjusts upwards to reach a new equilibrium price and quantity.

Let's Practise!

Are you able to explain the impact on equilibrium price and quantity when supply falls?

4.3 Effect of Simultaneous Shifts in Demand and Supply

In the dynamic world, both supply and demand conditions are constantly changing, therefore both supply and demand curves are likely to shift simultaneously. Given simultaneous shift of demand and supply, final effects on equilibrium price and quantity depends on the **relative magnitude** of change in demand and supply.

An increase in Both Demand and Supply

In a situation of increasing preference for smartphones by consumers increases its demand. At the same time, technological improvements have allowed smartphones to be produced at a lower cost such that supply increases as well. The **effect on market equilibrium price is indeterminate**.

From Figure 22, although the new equilibrium point will be to the right of E, the new price could be **above or below** P_0 , depending on the **relative shifts** of the demand and supply curves.

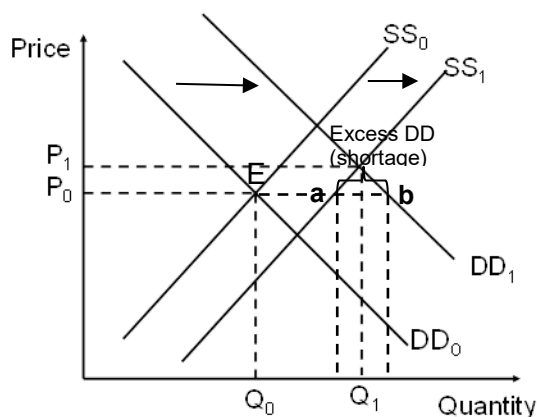


Figure 22

Assuming the increase in demand is greater than the increase in supply as reflected by the larger extent of shift in demand curve from DD_0 to DD_1 than the shift in supply curve from SS_0 to SS_1 . At the initial equilibrium price P_0 , a shortage (ab) will occur. There will be an upward pressure on price as consumers try to outbid one another for the existing supplies.

As the price rises, it becomes more profitable for firms to increase their output. Quantity supplied increases as reflected by an upward movement along the new supply curve SS_1 . The higher price also reduces consumers' ability to pay and willingness to pay as substitutes become relatively cheaper and their disposable income falls. This leads to fall in quantity demanded as reflected by an upward movement along the new demand curve DD_1 .

The process continues until the shortage is eliminated. At the new equilibrium, price has risen to OP_1 and quantity increased to OQ_1 .

Lecture exercise:

Attempt the exercises in Appendix A on Pg. 28 to analyse the different scenarios of simultaneous changes in demand and supply on equilibrium price and quantity.

Sectional Summary

- Changes in demand and supply would put the market in disequilibrium, and prices adjust to return markets to a state of equilibrium (i.e. market adjustment process).

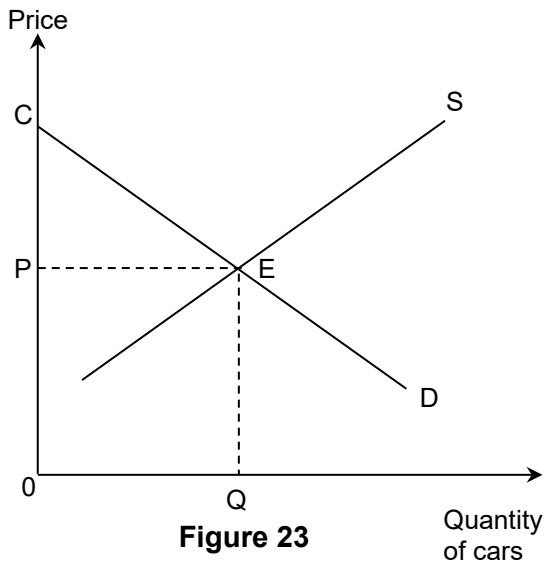
Recap: Use 3-steps analysis

1. Decide whether demand or supply is affected given the scenario.
2. Decide direction of shift in demand or supply curve and the demand / supply factor causing the change.
3. Explain how the market adjust to new equilibrium price and quantity given shifts in demand and supply curves.

5. ECONOMIC WELFARE

5.1 Consumers' Surplus

Consumers' surplus is the **difference** between the **maximum amount** that consumers are willing and able to pay for a given quantity of a good and what they **actually pay**. Consumers' surplus is also a measure of consumer welfare. The bigger the surplus, the higher the level of consumer welfare / satisfaction.



CD represents the DD curve for a particular good. Suppose the market price is $0P$ and quantity demanded is $0Q$.

The total amount that consumers pay for $0Q$ units
= price $\times$ quantity
= $0PEQ$

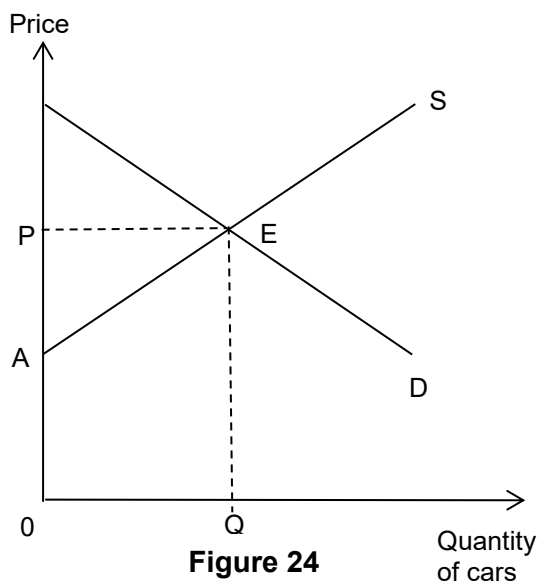
The amount that consumers are willing to pay for $0Q$ units
= $0CEQ$
= the area under the DD curve up to the level of quantity consumed, i.e. $0Q$
= value of total satisfaction/benefits from consuming $0Q$ units

Consumer Surplus

= total satisfaction/benefits consumers receive from buying $0Q$ units – the amount paid for $0Q$ units
= $0CEQ - 0PEQ$
= CPE
= area above the price line and below the demand curve up to output $0Q$.

5.2 Producers' Surplus

Producers' surplus refers to the **difference** between the **amount received** by producers for selling their good and the **minimum prices** that they are willing and able to accept for supplying additional units of the good.



Given the supply curve in the diagram, suppose $0P$ is the market price and quantity supplied is $0Q$.

At $0P$, the total amount that the producers actually receive for producing $0Q$ units
= price $\times$ quantity
= $0PEQ$

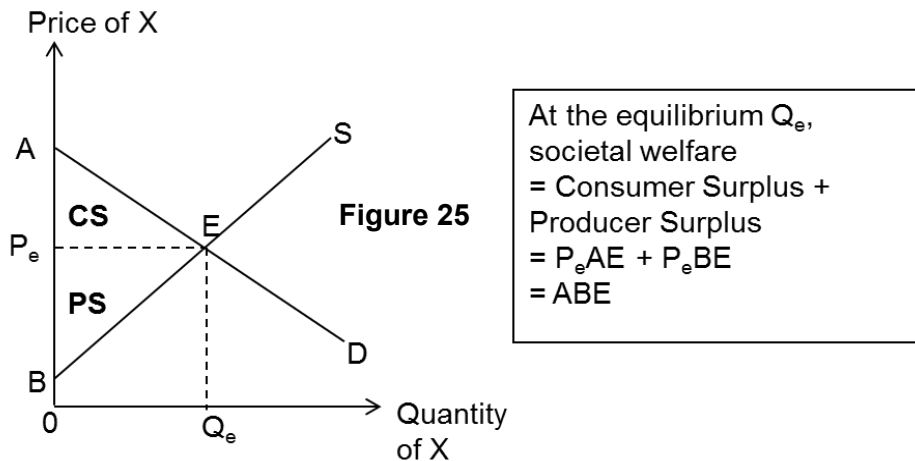
The minimum amount that the producers are willing to accept for $0Q$ units of the good
= $0AEQ$
= the area below the supply curve up to the quantity supplied at $0P$, i.e. $0Q$.

Producer Surplus

= $0PEQ - 0AEQ$
= APE
= area above the supply curve and below the price line up to the last unit produced, i.e. $0Q$.

5.3 Society's welfare

Society's welfare is the **sum of consumers' and producers' surplus**.



Significance of the concepts of consumers' & producers' surplus

When the sum of consumers' and producers' surpluses is maximised at the market equilibrium point, society will also maximise its total economic welfare and achieve economic efficiency in the absence of market failures (*to be taught in greater detail in Section 6*).

Free market decisions/actions of firms, households as well as government intervention will cause **welfare effects** on society, which can be measured in terms of the gains and losses in the consumers' and producers' surpluses.

Sectional Summary

- The price mechanism achieves maximization of consumer surplus and producer surplus by clearing shortages and surpluses in markets through the signalling, incentivizing and rationing functions.
- In the absence of market failure, the price mechanism achieves allocative efficiency by clearing shortages or surpluses in markets through signalling.
- The price mechanism allows for productive efficiency to be achieved in competitive markets as the adjustment of factor prices in the factor markets act as a signal and incentive for producers to adjust their production methods.

6. ROLE OF THE PRICE MECHANISM IN ALLOCATION OF RESOURCES IN A FREE MARKET

6.1 How does the Price Mechanism achieve Economic Efficiency

Economic efficiency broadly means the best possible use of resources and it exists when **both allocative and productive efficiencies are achieved in an economy**.

6.1.1 Allocative efficiency

Allocative efficiency is the situation in which the society produces and consumes a combination of goods and services that maximises its welfare. It is achieved when goods and services wanted by the economy are produced in the right quantities.

In the absence of market failures, the price mechanism achieves allocative efficiency by clearing shortages or surpluses in markets through **signalling**.

Suppose consumers decide they would like to eat more strawberries because of its health benefits (a change in tastes and preferences), consumers will signal to producers their preference for strawberries via an increased willingness to pay a higher price for strawberries. Hence, demand for strawberries increases and with reference to figure 26, demand curve shifts to the right from D_0 to D_1 . At the initial price, OP_0 , there is a shortage equal to the difference between Q_2 and Q_0 as quantity demanded (Q_2) is larger than quantity supplied (Q_0). Frustrated consumers bid up the prices of strawberries, resulting in upward pressure on price. The rise in price signals to producers that a shortage in the strawberry market had emerged.

Recall:
Signalling function of prices

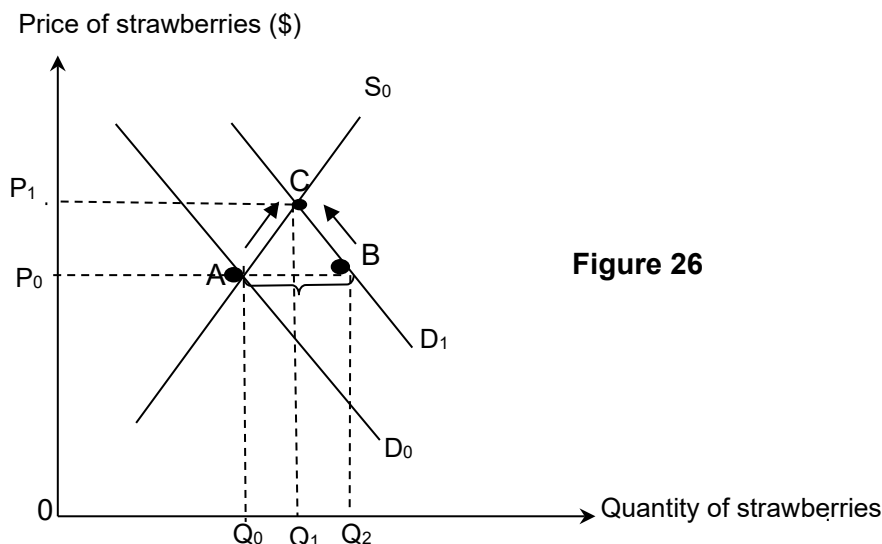


Figure 26

The increase in price is also an incentive for profit-maximising producers to increase the quantity of strawberries supplied. At the higher price, strawberry production is more profitable, so producers move along the supply curve from point A to point C, increasing quantity supplied. Previously unprofitable units become profitable as the higher price can now cover the higher marginal costs of producing Q_0Q_1 units.

Recall:
Incentive function of prices

However, at higher prices, the marginal utility of consuming Q_1Q_2 units is lower than the price consumers pay at OP_1 . Moreover, when price increases, real income falls which reduces purchasing power and substitutes like blueberries become relatively cheaper. Hence, both ability and willingness to consume falls when price increases. Consumers therefore move along the new demand curve from point B to point C,

buying fewer units of strawberries. The process of price adjustment continues until quantity demanded is equal to quantity supplied at the new equilibrium OP_1 and OQ_1 .

The increase in price of strawberries has resulted in a *reallocation of resources* as indicated by the increase in quantity of strawberries supplied. More resources are now allocated to strawberry production. The market is now in equilibrium again, and allocative efficiency is achieved. This answers the '**what and how much to produce**' question of resource allocation. With the increase in price of strawberries, consumers with more money will be able to consume more of the strawberries produced and this answers the '**for whom to produce**' question of resource allocation.

Recall:
Rationing function of prices

6.1.2 Productive efficiency

Productive efficiency is achieved when all resources are fully and efficiently utilised.

This gives rise to firms using the least cost method of production for a given amount of output. When all industries achieve productive efficiency, the economy will be producing on its production possibility frontier where it is impossible to produce more of one good without producing less of another. The price mechanism allows for productive efficiency to be achieved in competitive markets as the adjustment of factor prices in the factor markets act as a signal and incentive for producers to adjust their production methods in deciding how to produce with the least cost method of production. For example, when capital becomes relatively more expensive, profit-maximising firms will be incentivised to adjust their production methods, replacing capital with more labour to reduce their cost of production. For example, as wages rise in Singapore, *ceteris paribus*, profit-maximising firms in Singapore will substitute the more expensive labour with the relatively cheaper capital.

Recall:
Incentive function of prices

6.2 How desirable is the free market equilibrium?

The success of the competitive market in achieving allocative and productive efficiency seems to suggest that there should not be government intervention in markets, as the price mechanism works very well on its own. However, there are two important issues that arise.

The first is that efficiency can only be achieved under a number of very strict conditions that are unlikely/difficult to be met in the real world, for instance, perfectly competitive markets, absence of externalities and public goods. In the real world, markets may fail with respect to achieving both allocative and productive efficiency. Market failure is thus often an important justification for government intervention.

Note:
Different sources of market failure will be taught in detail under 'Microeconomic Objectives and Policies'.

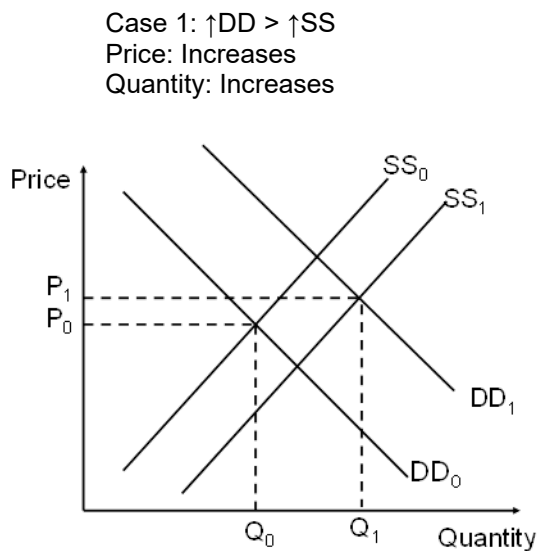
The second is that the competitive market is unable to provide a satisfactory answer to the '**for whom to produce**' question. This is because those with more dollar votes will be able to consume more of the goods produced, resulting in unfair distribution of goods with the wealthy consuming a disproportionately large share of what is produced. This thus invites some government intervention due to the problem of inequity.

Appendix A – Self-directed Learning

Draw diagrams for the 2 cases in each of the 4 scenarios (a to d) below and arrive at conclusions on the impact of the shifts in demand and supply on equilibrium price and quantity.¹

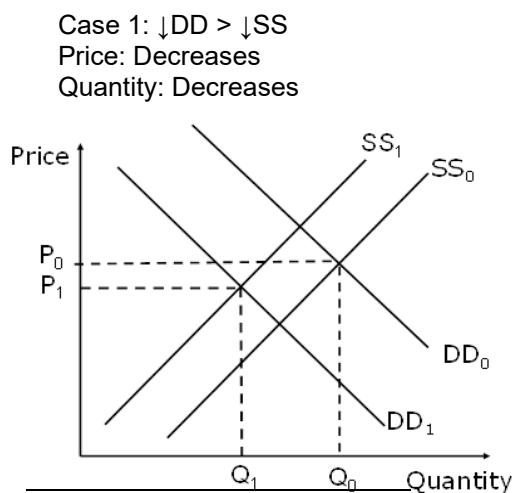
a. Increases in Both Demand and Supply

In a situation of rising incomes (demand increases) and increases in productivity (supply increases) the **effect on market equilibrium price is indeterminate**. In the diagram below, although the new equilibrium point will be to the right of E, the new price could be **above or below** P_0 , depending on the **relative shifts** of the demand and supply curves.



b. Decreases in both Demand and Supply

A situation of falling demand which result in a leftward shift of the demand curve, coupled with rising business costs leading to a decrease in supply. The combination of leftward shifts in both the demand and supply curves will cause the quantity exchanged in the market to decline. However, the **effect of this on the equilibrium price is indeterminate**, depending on the **relative shifts** of the demand and supply curves.

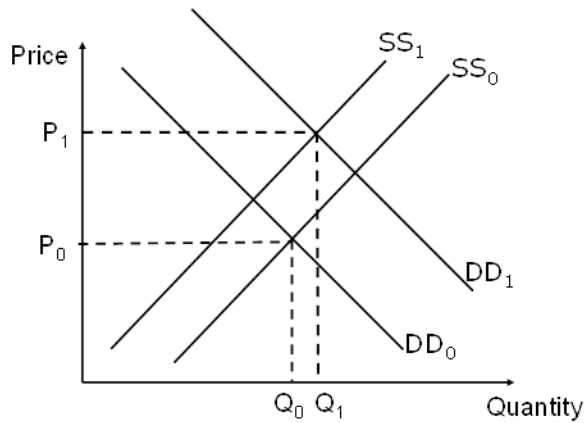


¹ You may refer to the videos uploaded onto IVY for the worked solutions

c. An Increase in Demand coupled with a Decrease in Supply

This will cause the equilibrium price to rise. These changes reinforce each other, leading to a higher price. However, the increase in demand due to rising incomes, while the decrease in supply due to increasing cost of production result in the **equilibrium quantity** to be **indeterminate**. It depends on the relative magnitude of the two changes.

Case 1: $\uparrow DD > \downarrow SS$
Price: Increases
Quantity: Increases



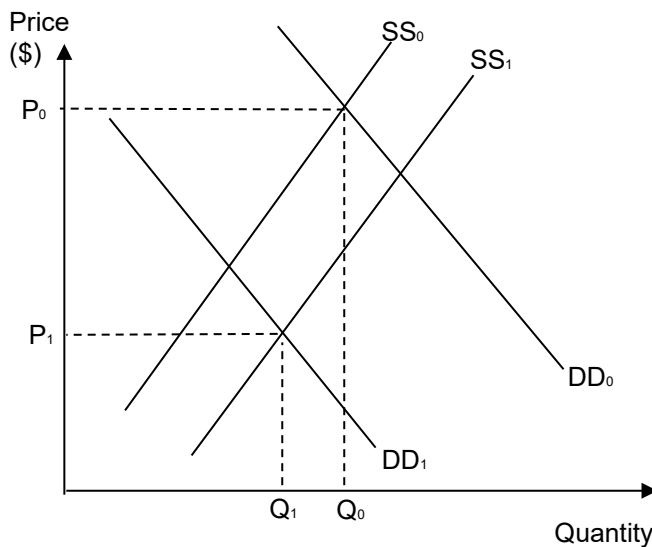
Case 2: $\uparrow DD < \downarrow SS$
Price: Increases
Quantity: Decreases



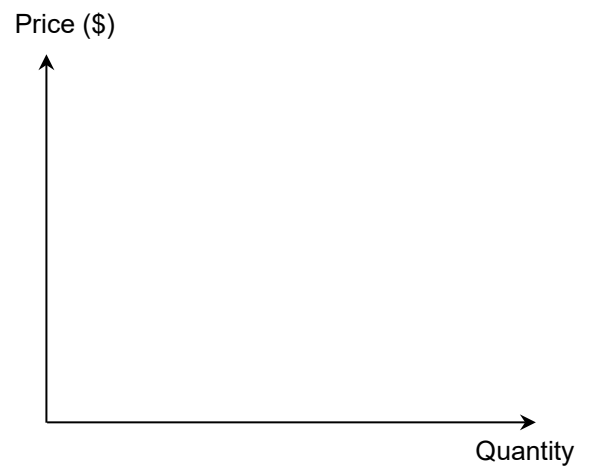
d. A Decrease in Demand coupled with an Increase in Supply

A decrease in demand coupled with an increase in supply will both cause equilibrium price to fall. However, the **effect on the equilibrium quantity exchanged** in the market is **indeterminate**. It depends on the relative magnitude of the two changes.

Case 1: $\downarrow DD > SS\uparrow$
Price: Decreases
Quantity: Decreases



Case 2: $\downarrow DD < SS\uparrow$
Price: Decreases
Quantity: Increases

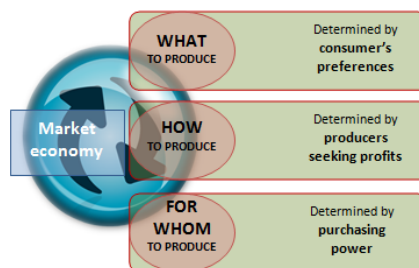


Appendix B – Economic Systems

There are two basic solutions to the economic problem as described by Paul Samuelson, namely free markets and central planning.

Free market economies

Markets enable mutually beneficial exchange between producers and consumers, and systems that rely on markets to solve the economic problem are called market economies. In a free market economy, resources are allocated through the interaction of free and self-directed market forces. This means that what to produce is determined by consumers, how to produce is determined by producers, and who gets the products depends upon the purchasing power of consumers. Market economies work by allowing the direct interaction of consumers and producers who are pursuing their own self-interest. The pursuit of self-interest is at the heart of free market economics.

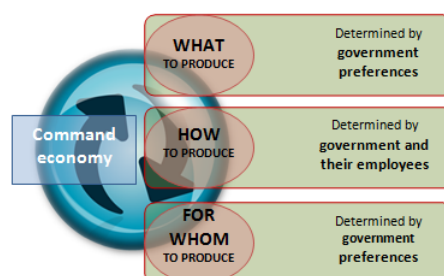


Command economies

The second solution to the economic problem is the allocation of scarce resources by government, or an agency appointed by the government. This method is referred to as central planning, and economies that exclusively use central planning are called command economies. In other words, governments direct or command resources to be used in particular ways. For example, governments can force citizens to pay taxes and decide how many roads or hospitals are built.

However, examples of full command economies no longer exist – China in the 1970s, and the USSR can be considered command economies.

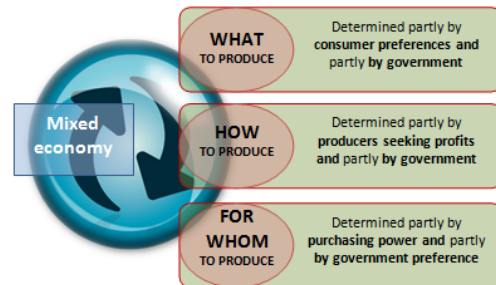
Command economies have certain advantages over free market economies, especially in terms of the coordination of scarce resources at times of crisis, such as a war or following a natural disaster. Free markets also fail at times to allocate resources efficiently, so remedies often involve the allocation of resources by government to compensate for these failures.



Mixed economies

There is a third type of economy involving a combination of market forces and central planning, called mixed economies.

Mixed economies may have a distinct private sector, where resources are allocated primarily by market forces, such as the grocery sector of the UK economy. Mixed economies may also have a distinct public sector, where resources are allocated mainly by government, such as defense, police, and fire services. In many sectors, resources are allocated by a combination of markets and planning, such as healthcare and, which have both public and private provision.



In reality, all economies are mixed, though there are wide variations in the amount of mix and the balance between public and private sectors. The key differentiation is the level of government intervention in the economy, and this exists on a spectrum. For example, in Cuba the government allocates the vast majority of resources, while in Europe most economies have an even mix between markets and planning. Economic systems can be evaluated in terms of how efficient they are in achieving economic objectives.

Reference

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RAFFLES INSTITUTION
YEAR 5 H2 ECONOMICS 2025

PRICE MECHANISM AND ITS APPLICATIONS (PART 2)

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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 degree 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 of Demand (PED)

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:

$$\begin{aligned} PED &= \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price of gd itself}} \\ &= \frac{\frac{\Delta Qd}{Qd_0}}{\frac{\Delta P}{P_0}} \\ &= \frac{\Delta Qd}{\Delta P} \times \frac{P_0}{Qd_0} \end{aligned}$$

1.1.2 Interpretation of PED

- Sign

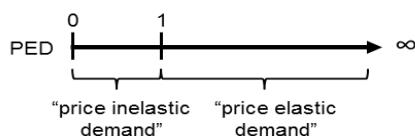
The sign of PED is normally negative because of the inverse relationship between price and quantity demanded. According to the Law of Demand, if there is an increase in price (positive change in the denominator), there will be a fall in quantity demanded (negative change in the numerator). Thus, as long 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.

Key Point:
The sign of PED is always negative due to the law of demand.

- Magnitude

The magnitude of absolute PED ranges between 0 to infinity. The larger the magnitude of the coefficient the greater the sensitivity of consumers to 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 PED² is < 1 when demand is price inelastic. Consumers are less sensitive to price changes, thus, quantity demanded is less responsive to changes in prices, *ceteris paribus*. A change in price will 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 lead to a more than proportionate change in quantity demanded, *ceteris paribus*.

²The absolute value of the PED (i.e. ignoring the negative sign).

Coefficient	Interpretation	Diagram
$ PED < 1$	Price inelastic demand A fall in price from P_0 to P_1 will lead to a less than proportionate increase 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 in price from P_0 to P_1 will lead to a more than proportionate increase 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 in price from P_0 to P_1 will lead to an equal proportionate increase 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 rectangular hyperbola.	
$ PED = 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.	
$ PED = \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.	

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

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:

- **Substitutes availability and closeness**

The availability of close substitutes is one of the most important determinants of PED. The greater the no. of close substitutes available, the more price elastic is its demand. For example, if the price of butter rises, consumers can easily switch to other substitutes e.g. margarine, causing a more than proportionate fall in quantity demanded for butter.

The availability of close substitutes may be affected by **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 more narrowly defined compared to "fruit". 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 that for apples.

- **Habituality of consumption**

Demand tends to be price inelastic if the good is consumed **habitually**. Quantity demanded is not very responsive to price changes as consumers are unable to change habits immediately and will continue to buy a similar amount of the good. For example, demand for rice in many Asian societies is relatively price inelastic compared to other Western countries because rice is considered 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.

- **Proportion of income spent on the good**

The higher the **proportion of income spent on a good**, 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 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, greatly discouraging the purchase of a new 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.

- **Period (time)**

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 can switch to other heating sources, such as gas, or they can install better insulation, and demand for heating oil becomes more price elastic.

Note:
It is important to know the determinants of PED. These include:

- **S**ubstitutes availability and closeness
- **H**abituality of consumption
- Proportion of **I**ncome
- **P**eriod (time)

Think:
What is the likely value of PED of bubble tea? Do you expect PED to be the same across every consumer segment?

1.1.4 Application of PED

Applying PED to explain extent of change in price and quantity when supply changes

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, demand for agricultural products is price inelastic ($|PED| < 1$) i.e. quantity demanded is unresponsive to price changes, and a large increase in price is needed to eliminate the persistent shortage. A rise in price will cause a less than proportionate fall in quantity demanded from Q_0 to Q_1 .

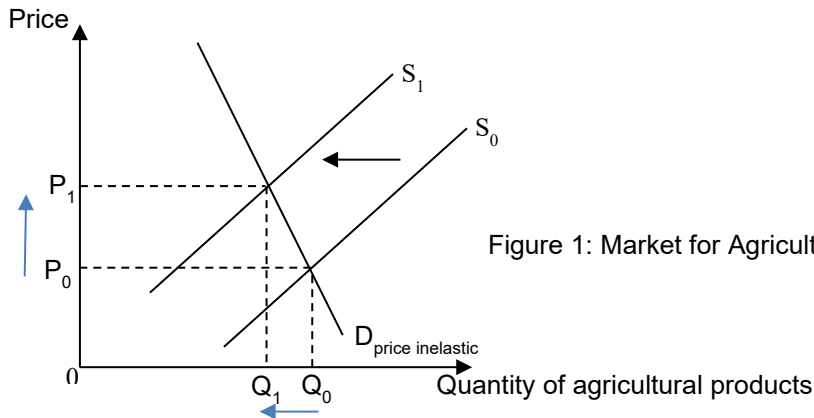


Figure 1: Market for Agricultural products

In contrast, the demand for luxury cruise services is price elastic because it is not habitually consumed and 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 eliminate the shortage. 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 P_0 to P_1 will cause a more than proportionate fall in quantity demanded from Q_0 to Q_1 , ceteris paribus.

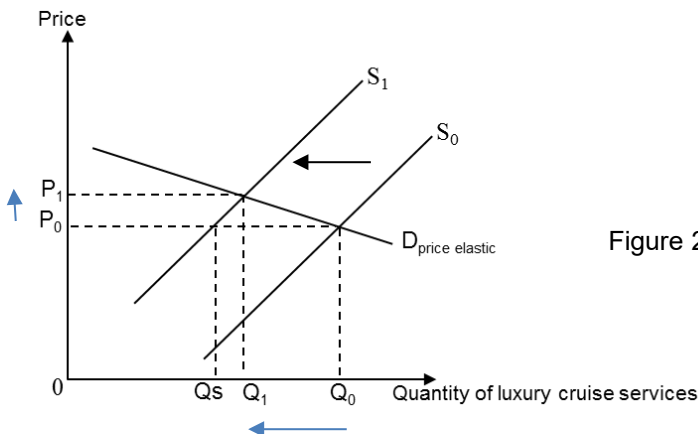


Figure 2: Market for luxury cruise services

Summary: Extent of P and Q changes when demand is price-inelastic vs price-elastic

	$ PED < 1$	$ PED > 1$
Rise in SS	$\downarrow P \rightarrow$ less than proportionate $\uparrow Q_d$	$\downarrow P \rightarrow$ more than proportionate $\uparrow Q_d$
Fall in SS	$\uparrow P \rightarrow$ less than proportionate $\downarrow Q_d$	$\uparrow P \rightarrow$ more than proportionate $\downarrow Q_d$

Applying PED to explain changes in Total Revenue (TR)/ Total Expenditure (TE) when supply changes

PED is also relevant for examining the impact of changes in price on the total revenue earned by producers / total expenditure spent by consumers when market supply 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 changes relative to the extent to which price changes is necessary.

Examining how a rise in price affects total revenue when $|PED| < 1$

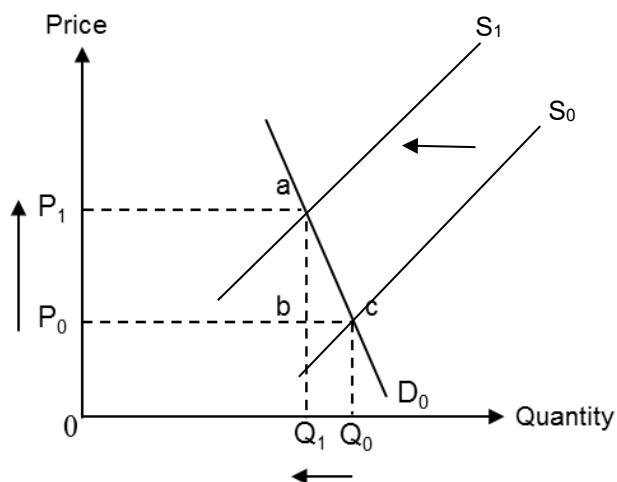


Figure 4: Market for agricultural products

With reference to 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). Overall, total revenue increases from Area $0P_0cQ_0$ to Area $0P_1aQ_1$.

Examining how a fall in price affects total revenue when $|PED| > 1$

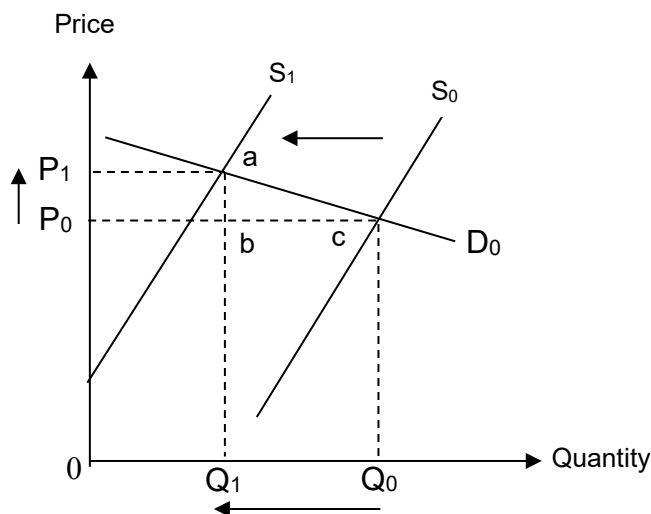


Figure 5: Market for luxury cruises

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). Overall, total revenue decreases from Area $0P_0cQ_0$ to Area $0P_1aQ_1$.

Summary: Impact on Total Revenue (TR) / Total Expenditure (TE) when price changes

	$ PED < 1$	$ PED > 1$
Rise in Price	$\uparrow TR$ due to the $\uparrow P > \downarrow TR$ due to the less than proportionate $\downarrow Q_d$ Overall, TR increases	$\uparrow TR$ due to the $\uparrow P < \downarrow TR$ due to the more than proportionate $\downarrow Q_d$ Overall, TR decreases
Fall in Price	$\downarrow TR$ due to $\downarrow P > \uparrow TR$ due to the less than proportionate $\uparrow Q_d$ Overall, TR decreases	$\downarrow TR$ due to $\downarrow P < \uparrow TR$ due to the more than proportionate $\uparrow Q_d$ Overall, TR increases

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 demand³. This will help them increase their revenue and as a consequence profits (where profits = total revenue - total cost) ceteris paribus.

Key Point:
PED may be used by firms in their decision-making.

In the case of a goods with price elastic demand where $PED > 1$, revenue will increase with a fall in price. This is because, the loss in TR due to a fall in price is smaller than the rise in TR due to an increase in quantity demanded, leading to an overall rise in TR. However, firms must also consider that total cost (TC) will increase as they increase the level of production to meet the increase in quantity demanded. Their profits will only increase if the increase in TR (due to the decrease in price) is higher than the increase in TC due to the increase in the level of production).

- In the long run, firms can focus on business strategies to make the demand of their products more price inelastic. For firms 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. Similarly, their profits will only increase if the increase in TR (due to the increase in price) is higher than the increase in TC due to the costs incurred from their strategies undertaken to product differentiate).

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

³A 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*.

1.2 Price Elasticity of Supply (PES)

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:

$$\begin{aligned} PES &= \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price of good itself}} \\ &= \frac{\Delta Q_s}{Q_{s0}} \div \frac{\Delta P}{P_0} \\ &= \frac{\Delta Q_s}{\Delta P} \times \frac{P_0}{Q_0} \end{aligned}$$

1.2.2 Interpretation of PES

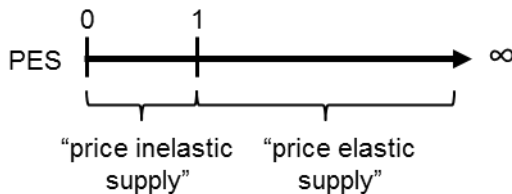
- Sign

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.

Key Point:
The sign of PES is always positive. The magnitude of PES is determined by the degree of responsiveness of quantity supplied when price changes.

- 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, ceteris paribus.

Coefficient	Interpretation	Diagram	Key Point: Analysis is usually focused on (i) $PES < 1$ (ii) $PES > 1$
$0 < PES < 1$	Price inelastic supply A rise in price from P_0 to P_1 will lead to a less than proportionate increase 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.		
$PES > 1$	Price elastic supply A rise in price from P_0 to P_1 will lead to a more than proportionate increase 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.		
$PES = 1$	Unitary (unit) price elastic supply A rise in price from P_0 to P_1 will lead to a proportionate increase 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.		
$PES = 0$	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.		
$PES = \infty$	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.		

1.2.3 Determinants of PES

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:

- **Stock/inventory levels**

The **level of stock** affects how readily producers can respond to price changes. When price rises and incentivises producers to increase the output 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, in the market, 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 output readily by drawing out these stocks. Thus, supply for non-perishables tend to be price elastic while supply for perishables tend to be price-elastic.

- **Availability of spare capacity**

If firms hold sufficient stocks of raw materials and have spare capacity (e.g., idle factories or equipment), they can readily increase output in response to a price rise. However, if the firm's capacity is fully utilized, expanding output becomes more difficult, making supply less elastic.

The availability of spare capacity is influenced by the **mobility of factors of production**. When factor inputs are highly mobile and can be easily reallocated within a firm's existing capacity, the firm effectively has greater spare capacity, leading to a more price-elastic supply.

- **Length of production**

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 output accordingly.

For instance, agriculture products tend to take a longer time to increase output due to **long gestation periods** of crops. Supply of agricultural goods is thus fairly price inelastic compared to of manufactured consumer goods that can be produced in factories in a comparatively shorter time. 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.

- **Time period**

In the **short run**, at least one factor of production is fixed, limiting a firm's ability to expand output, making supply relatively price inelastic. For instance, when the price of manufactured goods rises, firms can respond by increasing raw material orders and extending work hours. However, production remains constrained by fixed machinery and factory space.

In the **long run**, all factors of production become variable, allowing firms to expand capacity and new firms to enter the industry, making supply more price elastic. Over time, greater factor mobility—such as retraining workers and reallocating capital—further enhances firms' ability to adjust output in response to price changes.

Key Point:
It is important to know the determinants of PES. They include:

- **S**tock/ Inventory levels
- **A**vailability of spare capacity
- **L**ength of production
- **T**ime period

Question:
What kinds of food have a longer shelf life/ higher PES value?

1.2.4 Application of PES

Applying PES to explain extent of change in price and quantity in a market

When demand changes, the extent to which price and quantity supplied changes depends on PES.

Key Point
PES is **typically** used to analyse the effects of demand changes (shifts in demand curve) on price / quantity.

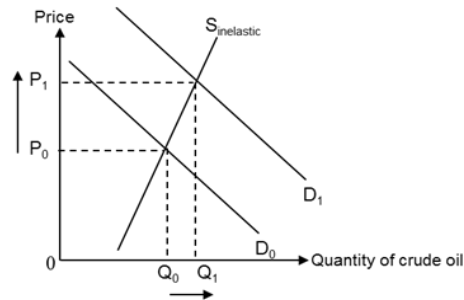


Figure 6: Market for Crude Oil

For instance, the demand for crude oil, a primary commodity, may rise due to a rising population with greater energy needs. With reference to Figure 6, demand rises from D_0 to D_1 . This rise in demand creates a shortage of crude 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), supply is price-inelastic $|PES| < 1$, 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 , ceteris paribus. Price of crude oil would need to increase by a large extent to eliminate the persistent shortage.

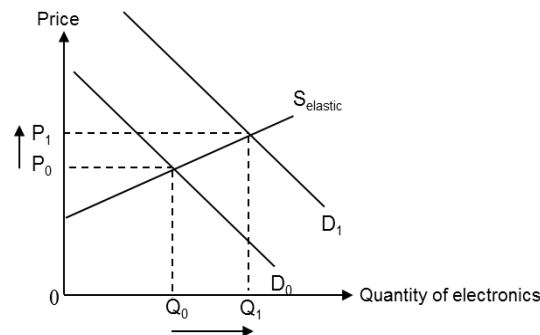


Figure 7: Market for consumer electronics

In contrast, the supply of consumer electronics is price elastic because it is easily produced and stocked up as inventory. If the demand for consumer electronics rises, a shortage is also created – but is more readily eliminated because producers can easily increase output in response to the rise in price. Thus, prices do not have to rise by much to clear the shortage. With reference to Figure 7, an increase in demand from D_0 to D_1 will cause a rise in price from P_0 to P_1 and a more than proportionate rise in quantity supplied from Q_0 to Q_1 , ceteris paribus.

Summary: Comparing the effect of rise in demand when $0 < PES < 1$ and when $PES > 1$

	$0 < PES < 1$	$PES > 1$
Increase in DD	$\uparrow P \rightarrow$ less than proportionate $\uparrow Q_s$	$\uparrow P \rightarrow$ more than proportionate $\uparrow Q_s$
Fall in DD	$\downarrow P \rightarrow$ less than proportionate $\downarrow Q_s$	$\downarrow P \rightarrow$ more than proportionate $\downarrow Q_s$

Think:
What happens to total revenue when demand increases:
If supply is price-elastic vs price-inelastic?

1.3 Cross Elasticity of Demand (CED)

1.3.1 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:

$$\begin{aligned} CED \text{ (of gd A wrt } \Delta \text{ price of gd B)} &= \frac{\% \Delta \text{ in quantity demanded of good A}}{\% \Delta \text{ in price of good B}} \\ &= \frac{\frac{\Delta Q_A}{Q_A}}{\frac{\Delta P_B}{P_B}} \\ &= \frac{\Delta Q_A}{\Delta P_B} \times \frac{P_B}{Q_A} \end{aligned}$$

1.3.2 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.

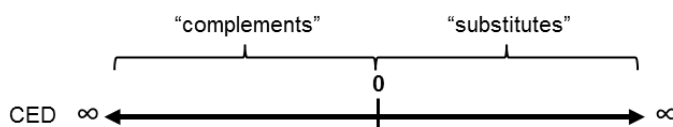
If CED is positive (CED > 0), the two goods are substitutes. An increase in the price of good B will lead to an increase in the demand for good A. For example, Pepsi substitutes Coca-Cola. If the price of Coca-Cola increases, the quantity demanded of Coca-Cola falls, and the demand for Pepsi will increase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

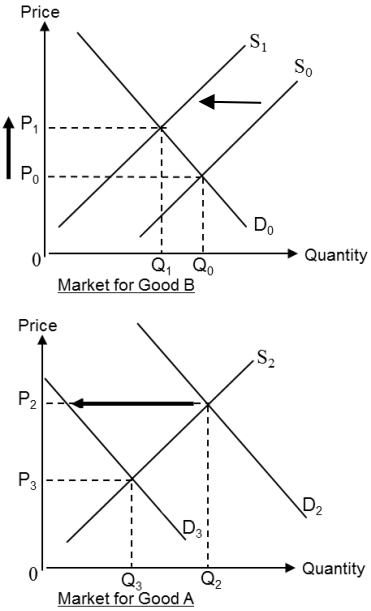
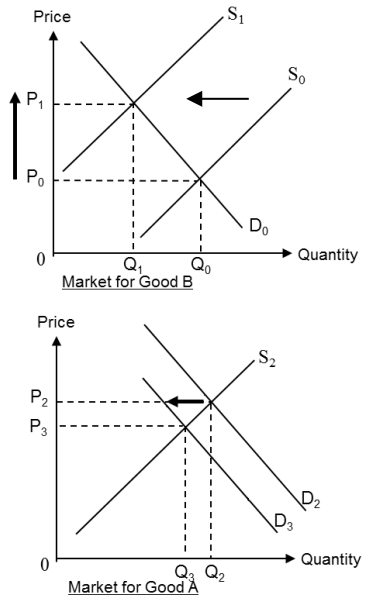
- Magnitude

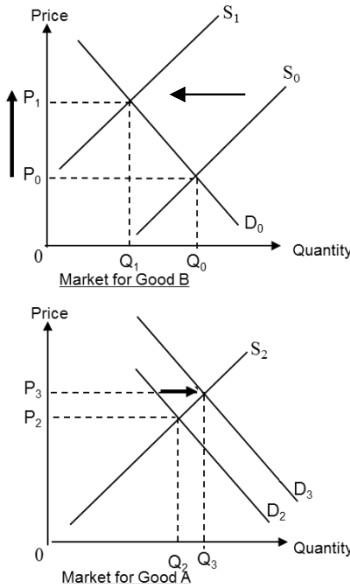
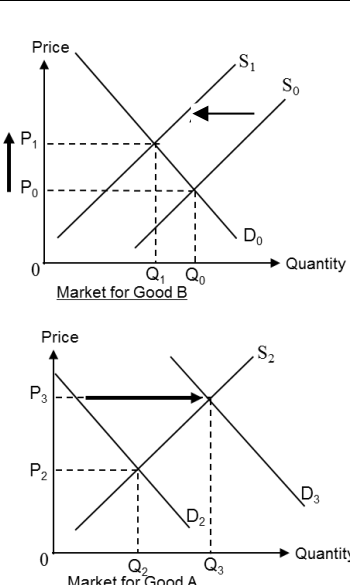
The magnitude of CED indicates the **strength of the relationship** between the two goods – be it substitutes or complements. The closer the substitutes/complements, the greater the magnitude will be.



The absolute value of Cross Elasticity of Demand (CED) increases as two goods become closer substitutes or complements. The stronger the substitutability or complementarity between two goods, the greater the impact of a price change in one on the demand for the other, resulting in a higher absolute CED value.

Key Point:
The sign of CED indicates the type of relationship between the two goods. The magnitude of CED is determined by the closeness of the relationship.

Coefficient	Interpretation	Diagram
$CED < 0$ & $ CED $ is large	Strong complements A rise in price of Good B from P_0 to P_1 will lead to a large decrease 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.	 The top diagram, labeled 'Market for Good B', shows a supply curve shifting leftward from S_0 to S_1. The equilibrium moves from (Q_0, P_0) to (Q_1, P_1), where $P_1 > P_0$ and $Q_1 < Q_0$. The bottom diagram, labeled 'Market for Good A', shows a demand curve shifting leftward from D_2 to D_3. The equilibrium moves from (Q_2, P_2) to (Q_3, P_3), where $P_3 < P_2$ and $Q_3 < Q_2$. The shift in the demand curve for Good A is large.
$CED < 0$ & $ CED $ is small	Weak complements A rise in price of Good B from P_0 to P_1 will lead to a small decrease 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.	 The top diagram, labeled 'Market for Good B', is identical to the one above, showing a leftward shift from S_0 to S_1 and equilibrium moving from (Q_0, P_0) to (Q_1, P_1). The bottom diagram, labeled 'Market for Good A', shows a small leftward shift from D_2 to D_3. The equilibrium moves from (Q_2, P_2) to (Q_3, P_3), where $P_3 < P_2$ and $Q_3 < Q_2$. The shift in the demand curve for Good A is small.

$CED > 0$ & CED is small	Weak substitutes A rise in price of Good B from P_0 to P_1 will lead to a small increase 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 in price of Good B from P_0 to P_1 will lead to a large increase 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.	

1.3.3 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.

The **main determinant of CED is the closeness of the substitute or complement of the two goods**, which is indicated by the magnitude of the CED. The closer the relationship between the two goods, the larger will be the effect on the demand for a given change in the price of the related good.

For instance, butter and margarine are considered substitutes because they serve the same primary purpose—as spreads for bread, in cooking, and in baking. When the price of butter rises, consumers may switch to margarine as a more affordable alternative, leading to a positive Cross Elasticity of Demand (CED). They are close substitutes because they have similar taste, texture, and functionality. Although there are differences in ingredients (butter is made from dairy, while margarine is typically plant-based), margarine is often marketed as a direct alternative to butter. The stronger the substitutability, the higher the absolute value of CED, as a price change in one leads to a significant demand shift for the other.

Printers and ink cartridges, on the other hand, are complements because they are used together—anyone who purchases a printer will inevitably need ink cartridges to operate it. A fall in the price of printers due to an increase in supply leads to a rise in demand for ink cartridges, *ceteris paribus*. Ink cartridges are strong complements to printers because a printer is essentially useless without ink. As a result, the cross elasticity of demand (CED) for ink cartridges with respect to the price of printers is highly negative.

1.3.4 Application of CED

Applying CED to explain impact on related markets

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. For instance, the sign and value of Cross Elasticity of Demand (CED) are crucial in analyzing the market-level impact on non-sugar sweetened beverages when the price of sugar sweetened beverages increases.

Key Point:

CED can be used to analyze the impact on related markets, providing valuable insights for policymakers.

CED is relevant when the price of a related good changes, helping to predict shifts in demand. Since non-sugar sweetened and sugar sweetened beverages are substitutes, the CED between them is positive. This means that when the price of sugar sweetened beverages increases, the demand for non-sugar sweetened beverages rises which causes a shortage at the initial price and in turn an upward pressure on price. The increase in price incentivizes producers of non-sugar sweetened drinks to increase production because previously unprofitable units are now profitable. Hence, equilibrium price and quantity (or sales volume) as well as sales revenue increase in the market for non-sugar sweetened beverages.

Exam Tip:

When exam questions ask for impact on related markets, address the impact on P and Q.

Depending on the question and mark allocation, impact on TR, and long run impact on P and Q and TR may be required.

In the short run, the CED value is likely to be low because many consumers who specifically enjoy the sweetness of sugar sweetened beverages may not view non-sugar sweetened beverages as a close substitute. As a result, when the price of sugar sweetened drinks increases, the demand for non-sugar sweetened beverages rises only slightly. This creates a small shortage at the initial price, leading to a modest increase in both equilibrium price and quantity. Consequently, sales revenue also rises slightly.

In the long run, factors such as increasing health awareness may shift consumer preferences toward non-sugar sweetened beverages, leading to a higher CED value. In the long run, sales revenue for non-sugar sweetened beverages is likely to increase as demand continues to rise due to shifting consumer preferences and health awareness.

CED and policy implications

Understanding CED helps policymakers anticipate market shifts and assess the impact of policies like sugar taxes.

If CED is high, the tax will likely drive consumption toward healthier options. If demand for non-sugar sweetened beverages rises significantly, the policy is more likely to achieve its goal of reducing sugar consumption.

If CED is low, consumers might not switch to healthier drinks but instead continue buying sugar-sweetened drinks despite higher prices or substitute them with other unhealthy options like high calorie fruit juices (like grape juice when consumed in excess). Policymakers may then need additional strategies, such as stricter regulations or incentives for healthier choices.

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 large, 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

Key Point:

Firms also use CED in their decision-making processes to better understand market dynamics and make informed strategic choices.

product. This fall in demand reduces the firm's revenue, and consequently profits, *ceteris paribus*. Thus, the firm respond to changes in the price of the rival's product with various strategies.

For instance, the firm can 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. Another strategy that firms can adopt would be to reduce prices to limit the loss in sales and remain competitive.

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 absolute value of the CED between the two products is high, 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 large rise in demand increases the firm's revenue and consequently profits by a large extent, *ceteris paribus*. The firm should plan for a large increase in the production of the good by allocating significantly more resources to the product or release inventory/stocks to leverage on this.

Think:

What other examples of complementary products/ joint promotions can you think of?

1.4 Income Elasticity of Demand (YED)

1.4.1 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:

$$\begin{aligned} YED &= \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}} \\ &= \frac{\Delta Q}{Q_0} \div \frac{\Delta Y}{Y_0} = \frac{\Delta Q}{\Delta Y} \times \frac{Y_0}{Q_0} \end{aligned}$$

1.4.2 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)⁴. 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. 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

Key Point:

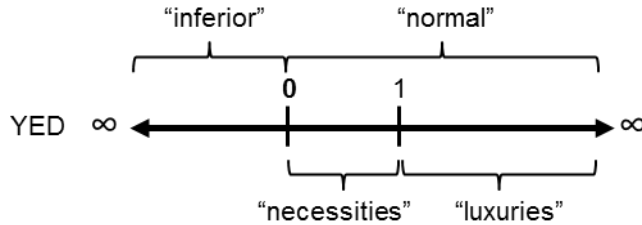
The sign of YED differentiates between normal and inferior goods. The magnitude of YED (when it is positive) is determined by the degree of necessity of the normal good.

⁴The 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.

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 strength of the relationship between income and the demand for the good is a deciding factor when consumers make decisions about purchasing the good.

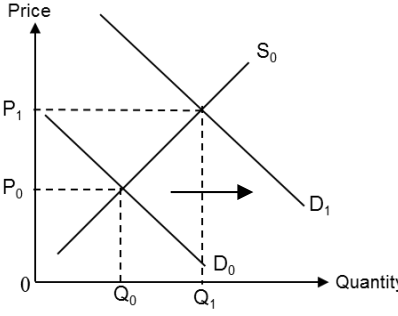


For normal goods, if the YED is positive and less than one ($0 < YED < 1$), then the good is classified as a **necessity**. The demand for the good is positively income inelastic. This means that income is not a strong determinant of consumers' demand. A rise (fall) in income will therefore lead to a 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 in income will lead to a 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% decrease in quantity demanded, ceteris paribus. (The magnitude of the shift depends on the magnitude of the absolute value of the YED)	
$0 < YED < 1$	Normal good - Necessity A rise in income will lead to a less than proportionate 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% increase in quantity demanded, ceteris paribus. There is a small rightward shift in the demand curve for good A.	

Recall:
What are positive and normative statements?

$YED > 1$	Normal good - Luxury A rise in income will lead to a more than proportionate increase 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.	
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1.4.3 Determinants of YED

Factors determining whether YED is positive (normal good) or negative (inferior good)

Typically, the demand for a normal good will rise as income rises and vice versa. On the other hand, the demand for an inferior good will fall as income rises, and vice versa. As such, inferior goods have negative YED values while normal goods have positive YED values.

- **Level of income and perceived or real quality of the good**

When income increases, consumers often substitute low-quality goods with higher-quality alternatives. For instance, as income rises, consumers replace generic brand products with luxury brands that offer superior features or perceived status value. The shift typically reflects consumer preferences for higher-quality, healthier, or more prestigious alternatives, aligning with their improved purchasing power.

Goods perceived as high quality or luxury items are more likely to be normal goods, as they align with consumer preferences for better goods when income rises. On the other hand, goods with lower perceived quality or associated with basic needs and budget-conscious consumption are often inferior goods. For example, store-brand groceries or second-hand clothing may fall into this category.

Factors determining whether the YED value for normal goods is less or more than 1

Whether a normal good is classified as a necessity ($YED < +1$) or a luxury ($YED > +1$) depends on its degree of necessity.

Degree of necessity

Normal goods may have $YED > 1$ or $0 < YED < 1$. $|YED|$ is dependent on the **degree of necessity of the good**. 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. These goods are considered essential for daily life, but their demand does not rise dramatically as consumers' incomes increase, since they are already being consumed regularly. In contrast, luxury foods such as high-quality cuts of meat usually have positive income elasticities that are more than one. When income rises, demand for luxury food items increase and to a more than proportionate extent, ceteris paribus.

The degree of necessity depends significantly on **the level of income of the consumer base**. For instance, in markets with low-income consumers, only basic necessities are considered essential, while many other items are classified as luxuries. However, as consumer income rises and lifestyles evolve, fewer goods and services are perceived as luxuries. For example, a meal at a mid-range restaurant might be considered a luxury in a market with low-income levels (e.g., in developing countries), but in an affluent market, it

could become a common experience and even a necessity for some. Similarly, a hawker meal, typically considered a normal good in lower-income markets, may be viewed as an inferior good in more affluent markets, where consumers might prefer higher-quality dining options.

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.

1.4.4 Application of YED

Applying YED to explain changes in market 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 for different types of goods—inferior goods, necessities, and luxury during economic booms and recessions. These differences ultimately affect equilibrium price, quantity, and total revenue (TR) in their respective markets.

Key Point:
YED can be used to analyse impact on a market's price, output and sales revenue.

During economic booms, demand for inferior goods ($YED < 0$) falls as consumers switch to higher-quality alternatives. For example, in developing countries, instant noodles and budget-brand canned food are commonly consumed by lower-income households. However, as incomes rise, many consumers shift to fresh food and restaurant dining, reducing demand for these cheaper alternatives. As a result, firms selling inferior goods experience a fall in price, quantity, and total revenue. Conversely, during economic downturns, more consumers rely on these lower-cost alternatives, increasing their demand and leading to higher equilibrium price, quantity, and total revenue for firms in this market.

For necessities ($0 < YED < 1$), demand rises with income, but less than proportionately since these goods are essential and have a consumption limit. Staple foods like rice and bread, as well as utilities like electricity and water, exhibit such behavior. When incomes rise, people may buy slightly more, but the increase is not drastic. For instance, in Singapore, demand for public transportation services like MRT and buses increases as the population grows, but even as incomes rise, most individuals do not drastically increase their usage of public transport. Consequently, price and quantity see a moderate increase, leading to a modest rise in total revenue for firms or service providers. In contrast, during recessions, consumers may cut back slightly, but the demand remains relatively stable, causing only a small decline in price, quantity, and total revenue.

In contrast, luxury goods ($YED > 1$) see a demand surge when incomes rise, as consumers allocate a greater share of their additional income to non-essential items. For example, during periods of strong economic growth, there is a significant increase in demand for luxury handbags from brands like Louis Vuitton and Chanel, high-end sports cars like Ferrari, and premium travel experiences such as business-class flights and luxury cruises. These goods experience a large rise in price, quantity, and total revenue as consumers splurge on status symbols and exclusive experiences. However, during economic downturns, demand for these goods drops sharply as consumers prioritize essential spending, causing a sharp decline in price, quantity, and total revenue for luxury brands.

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.

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.

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.

For instance, 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 including channeling more resources into developing better quality products with $YED > 1$. For instance, travel agencies could offer more luxurious holiday packages instead of budget travel packages. Smartphone companies could also 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 including channeling 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 stock up 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. Firms may also promote their inferior goods to capture a larger share of the rising demand for inferior goods in the market.⁵

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 supermarket to stock up on goods with $YED > 1$ i.e. luxurious items, at all its outlets nation-wide. However, the classification of what is considered luxurious can differ across different consumer bases. For example, as household incomes rise, the supermarket's outlets in the higher income districts would carry more premium items such as caviar and foie gras which it's high-income consumers consider luxurious. While at the outlets in the heartlands, the supermarket will stock up more of items such as organic food which the consumers in the area consider luxurious. In this way, the supermarket will benefit from a large increase in demand for its (luxurious) goods across different consumer bases.

Think:

Governments, like the US, are issuing cash handouts to citizens due to the COVID-19 pandemic. Which industries are likely to benefit from such cash handouts?

What is the purpose of cash handouts?

Key Point:

YED is used by firms and governments in their decision-making.

⁵ 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.

1.5 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 elasticity concepts, economists often face difficulties in calculating accurate values due to challenges in data collection. For example, calculating Price Elasticity of Demand (PED) requires reliable data on price changes and the corresponding changes in quantity demanded. However, errors can arise if data collection methods are flawed or inaccurate, such as relying on sales estimates, incomplete surveys, or poorly tracked consumer behavior.

Question:

Are these computational concerns still a challenge today? Why or why not?

For instance, companies in the sugar-sweetened beverage industry may collect data from store sales or surveys to estimate PED. However, if the data collection is inconsistent—like limited sample sizes, inaccurate reporting by retailers, or failure to account for factors such as promotions or seasonal demand—the calculated PED value may be misleading. This could lead companies to make incorrect decisions, such as mispricing their products or overestimating the impact of a price change, potentially hurting their market performance.

- Issues with prediction

If a company relies on outdated elasticity estimates, it might struggle to predict future demand accurately, leading to poor pricing or production or marketing decisions in a market that is evolving rapidly with new technologies and consumer habits. In today's dynamic economy, the rise of online shopping and digital platforms has drastically changed consumer behavior. For instance, companies like Amazon may calculate price elasticity based on past sales data. However, in the fast-changing world of e-commerce, shifts in consumer preferences, promotional trends, or new competitors can quickly make past data irrelevant.

- 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 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. When a firm steps up production to meet the increase in quantity demanded for the product, this also means an increase in production costs. If so, given that $\text{profit} = \text{total revenue} - \text{total cost}$, profit might not increase.

- Ceteris paribus assumption

The statement “all other things being equal” is a very strict assumption that does not hold in reality. The results that are calculated from the static analysis may be 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 real-world markets are affected by many concurrent factors, so PED values derived under the assumption of ceteris paribus may not accurately reflect market outcomes. 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. When demand is price elastic, a fall in price will lead to a rise in total revenue.
- 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.
- 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 failure⁶. Taxes may be indirectly imposed when the tax is imposed on expenditure on goods and services, or it may be directly imposed on income and wealth.

2.1.1 Indirect taxes

Indirect taxes are **taxes on goods and services** and are **paid to the tax authorities 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%).

Key Points:
Indirect taxes shift supply curve.

An indirect tax is levied on producers. Indirect taxes have the effect of increasing the cost of production for firms which leads to an upward 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.

⁶Market 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*.

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 cause price to rise from P_0 to P_1 and quantity traded to fall from Q_0 to Q_1 . Government will receive tax revenue of Area P_1P_0ac .

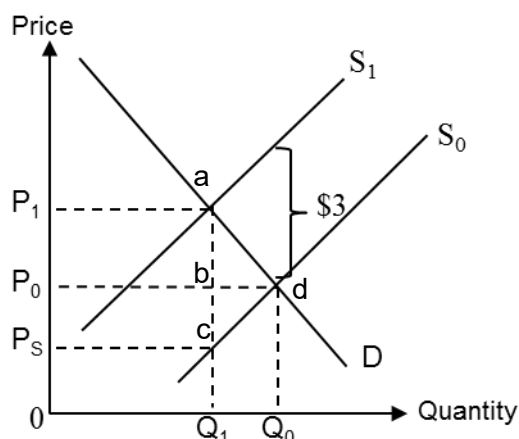


Figure 9

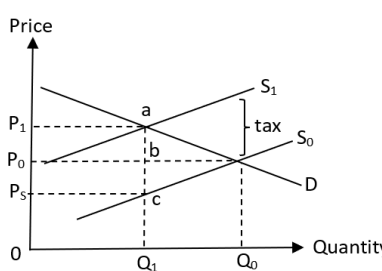
Note:
It is important to analyse the impact of tax on equilibrium price, quantity and tax revenue.

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. Total expenditure changes from P_0Q_0 to P_1Q_1 . Whether total expenditure increases, or decreases depends on PED. If PED is > 1 , total expenditure will decrease. If PED is < 1 , total expenditure will increase.
- Producer's total revenue (after-tax) will fall as it is producing less and receiving less after-tax revenue for each unit of the good sold. In this case, total revenue fell from P_0Q_0 to P_sQ_1 .

	Market Outcomes	Diagram
Relatively low PED	With the tax (=ac), the supply curve shifts upwards from S_0 to S_1. Price increases from P_0 to P_1 while quantity demanded decreases less than proportionately from Q_0 to Q_1. The government receives a relatively larger tax revenue given by area P_1P_0ca. Post-tax consumers' surplus and producers' surplus will both fall. However, the loss of consumers' surplus $>$ loss of producers' surplus. Consumers are thus more negatively affected by the indirect tax.	

Relatively high PED	With the tax (=ac), the supply curve shifts upwards from S_0 to S_1. Price increases from P_0 to P_1 while quantity demanded decreases more than proportionately from Q_0 to Q_1. The government receives a relatively smaller tax revenue given by area P_1P_sca. Post-tax consumers' surplus and producers' surplus will both fall. However, the loss of consumers' surplus < loss of producers' surplus. Producers are thus more negatively affected by the indirect tax.	
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Think:

Can you name an example of a market with relatively low/high PED?

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.

If the free market output level Q_0 in Figure 10 is initially allocatively efficient and the government's objective in imposing an indirect tax (equal to P_1P_s or ef) is to raise tax revenue, social welfare will be negatively affected.

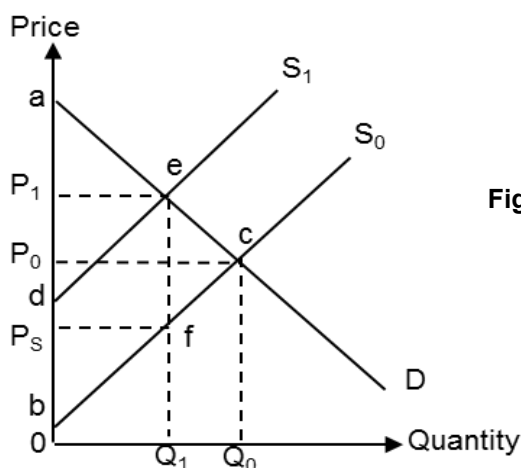


Figure 10

Effect of indirect tax (specific) on welfare

- Post-tax consumer surplus falls from Area P_0ac to Area P_1ae . There is a loss of consumer surplus of Area P_0P_1ec .
- Post-tax 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.

Post-tax consumer surplus fell because with the imposition of the sales tax, the actual price consumers pay increased from P_0 to P_1 , hence the difference between the maximum price consumers are willing and able to pay and the actual price consumers have to pay has fallen. In addition, consumers also see a fall in the quantity of good consumed from Q_0 to Q_1 .

Post-tax 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 resulting in a smaller difference between the actual price retained by producers and the minimum price they must receive for the unit to be profitable. In addition, the quantity of goods 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.

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 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 normal goods and services including food, ceteris paribus. The demand curve for food shifts from D_0 to D_1 in Figure 11. This results in a surplus at P_0 which will cause price to fall from P_0 to P_1 and quantity traded to fall from Q_0 to Q_1 . Total expenditure/revenue decreases from P_0Q_0 to P_1Q_1 . Consumers' surplus and producers' surplus both fall due to the lower quantity traded.

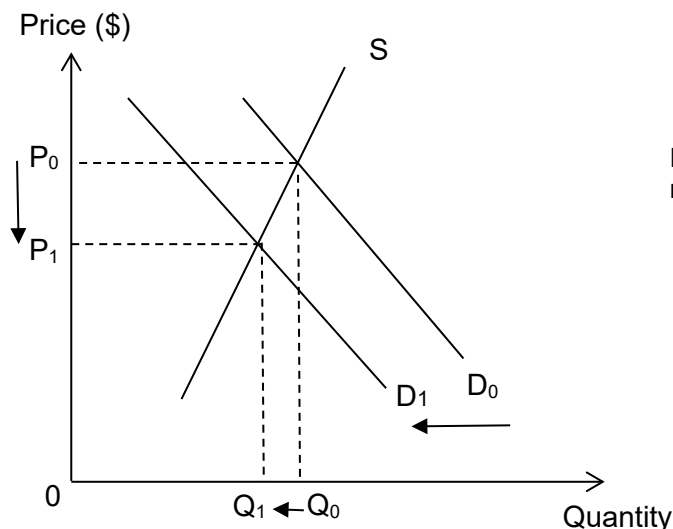


Figure 11: Effect of direct tax on market for food

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 to suppliers of goods and services (i.e via indirect subsidies) or to households (via direct subsidies).

When analysing the effects of a subsidy, economists analyse its impact on equilibrium price and quantity, total revenue/expenditure, government expenditure, consumers' and producers' surplus.

2.2.1 Indirect subsidies

Indirect subsidies work like negative indirect taxes. They are **granted by the tax authorities 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 subsidies has the effect of lowering the cost of production for firms, they increase profitability and provide an incentive to produce more at every price. This leads to an increase in supply, shifting the supply curve to the right.

Specifically, **the supply curve shifts downward by the amount of the subsidy**, meaning that at any given quantity, firms are willing to accept a lower price due to the reduced cost of production.

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 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 traded to rise from Q_0 to Q_1 . There will be an increase in government expenditure on subsidies of P_1P_sac .

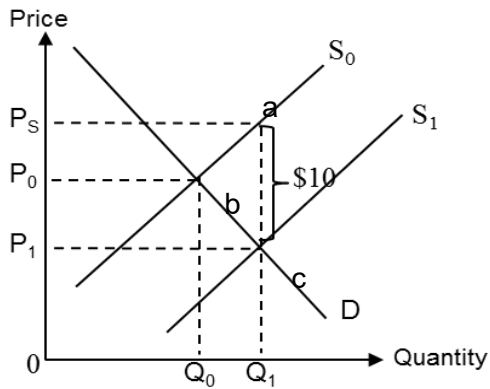


Figure 12: Effect of indirect subsidy (specific) on the market for food

Note:
It is important to analyse the impact of subsidies on equilibrium price, quantity and government expenditure.

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).

- Consumers who used to pay P_0 now pay P_1 since the equilibrium price has changed after the fall in supply. Total expenditure changes from P_0bQ_0 to P_1cQ_1
- 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. Total revenue (after-subsidy) increases from P_0bQ_0 to P_saQ_1 .
- There will be an increase in government expenditure on subsidies of P_1P_sac (subsidy per unit $\times Q_1$).

	Market Outcomes	Diagram
Relatively low PED	With the subsidy ($=ac$), the supply curve shifts downwards from S_0 to S_1. Price decreases from P_0 to P_1 while quantity demanded increases less than proportionately from Q_0 to Q_1. The government expenditure on the subsidy is relatively small. Government expenditure on subsidy is Area P_1P_sac in total. Post-subsidy consumers' surplus and producers' surplus will both increase. However, the gain of producers' surplus $<$ gain of consumers' surplus. Consumers are thus more positively affected by the indirect subsidy.	
Relatively high PED	With the subsidy ($=ac$), the supply curve shifts downwards from S_0 to S_1. Price decreases from P_0 to P_1 while quantity demanded increases more than proportionately from Q_0 to Q_1. The government expenditure on the subsidy is relatively large. Government expenditure on subsidy is Area P_1P_sac in total. Post-subsidy consumers' surplus and producers' surplus will both increase. However, the gain of consumers' surplus $<$ gain of producers' surplus. Producers are thus more positively affected by the indirect subsidy.	

Indirect subsidies also **impact 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 market inefficiency 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.

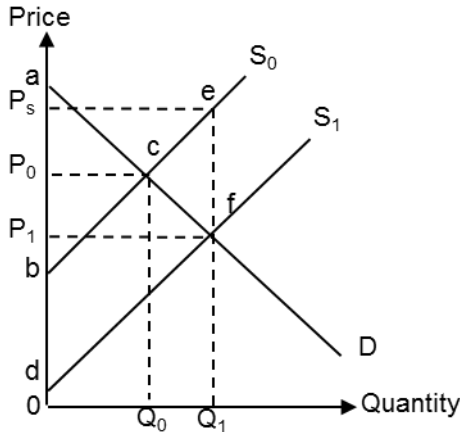


Figure 13: Effect of indirect subsidy (specific) on welfare

- Post-subsidy consumer surplus rises from Area P_0ac to Area P_1af . There is a gain in consumer surplus of Area P_1P_0cf .
- Post-subsidy producer surplus rises from Area P_0bc to Area P_sbe . There is a gain in producer surplus of Area P_0P_sce .
- Government expenditure on subsidy is Area $P_1P_s ef$. 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_sceP_0) + change in government expenditure ($-P_1P_s ef$). There is an overall loss of society's welfare of Area cef . This constitutes a deadweight loss to society.

Post-subsidy consumer surplus rose because with the grant of the indirect subsidy, the actual price consumers must pay has decreased from P_0 to P_1 , hence the difference between the maximum price consumers are willing and able to pay and the actual price they pay has increased. 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 , hence the difference between the actual price producers receive and the minimum price they must receive has increased. In addition, 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.

Key Point:
Direct subsidies shift demand.

Direct subsidies (consumption subsidies) are financial aids provided directly to consumers to influence their purchasing behavior. Direct subsidies can be given to households in the form of cash grants.

The primary objective of consumer subsidies is to assist low-income households by increasing their effective demand for essential goods. For example, if the subsidy is lump sum in nature, such as a \$100 cash voucher per person, it directly enhances consumers' ability to purchase more goods, such as food. Despite the increase in market price due to higher demand, consumers' ability to pay rises, enabling them to consume more. Consumer surplus (CS) increases as households can now afford more goods while still paying a price lower than their maximum willingness to pay. Additionally, as quantity consumed rises, the total benefit consumers derive from the market expands, further contributing to the overall increase in consumer surplus.

The higher demand generates a new equilibrium where both the price and quantity sold are higher, directly benefiting producers in terms of higher post-subsidy total revenue. Producer surplus (PS) also increases because the difference between the actual price that they receive and the minimum price they must receive is now higher, and they also sell more now.

However, the higher market price may reduce the effectiveness of the subsidy. The purchasing power of the lump-sum cash voucher diminishes as prices increase, limiting the intended impact of the subsidy. Moreover, consumers who are not eligible for the subsidy face higher prices and are adversely affected by this policy. The government also incurs the fiscal cost of funding the subsidy. This expenditure represents an opportunity cost, as the funds could have been used for other public goods or services.

The overall welfare impact depends on the balance between the increase in consumer and producer surplus and the fiscal cost to the government. If the subsidy is well-targeted and achieves its redistributive goal without significant inefficiencies, the net welfare impact is likely positive, particularly in terms of equity and social welfare. However, if the subsidy leads to excessive price inflation, significant adverse effects on non-recipient consumers, or substantial fiscal strain, the net welfare impact may be negative.

To maximize the positive welfare impact of direct subsidies, the government should ensure subsidies are well-targeted to low-income households, minimizing the negative effects on non-recipient consumers. This can be achieved by adopting tiered subsidies where higher subsidy amounts are given to the most vulnerable groups. The government also needs to prevent excessive price inflation, such as by encouraging competition among producers or regulating prices temporarily. By focusing on targeted and efficient implementation, the government can enhance equity while minimizing distortions and negative spillovers.

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**.

Key Point:
Price floors are set above the equilibrium price and result in surpluses.

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

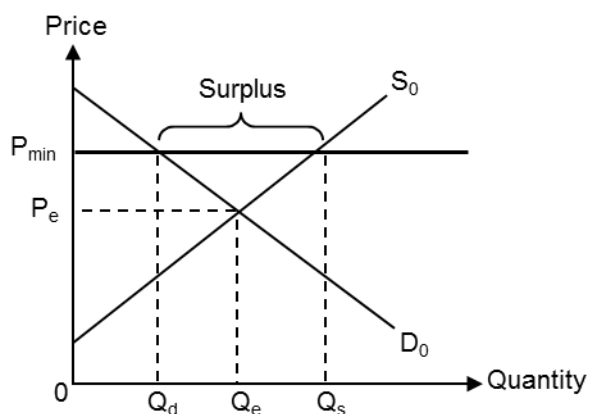
- To protect producers' incomes, especially when prices are volatile
- To create a surplus which can be stored in preparation for future shortages
- In the case of minimum wages, to prevent workers' wage rates from falling below a certain level

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 $Q_d Q_s$ 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**.



Think:
What are some examples of minimum price policies you can think of?

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 of Q_dQ_s at P_{min} to keep the minimum price policy viable**.

Think:

Are you able to illustrate a case of minimum price without government buyback? What will be the welfare effects?

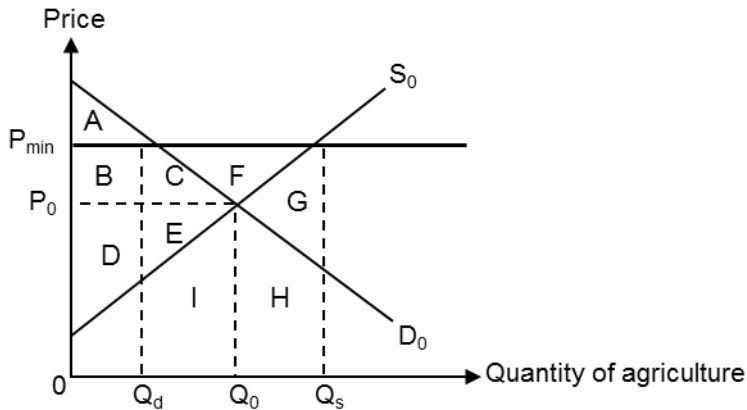


Figure 16: Effect of minimum price on welfare

- 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 agriculture goods 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}) $\times$ 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 $[-(\text{Area B+C})]$ + 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 can be resold or redistributed, the deadweight loss incurred by the society will be significantly smaller.

2.3.2 Maximum price

A maximum price is a **price ceiling**, which is a legally established 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.**

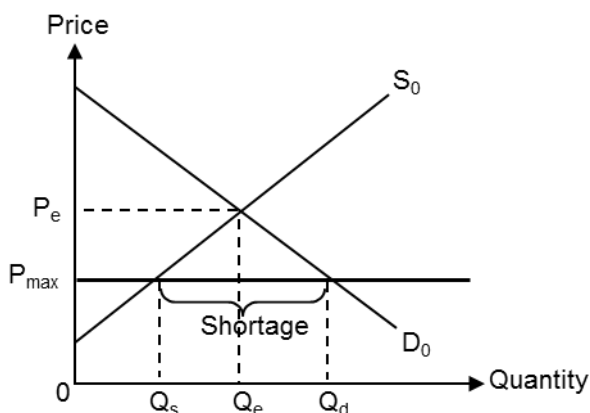


Figure 17: Effect of maximum price (price ceiling) on a market

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 equilibrium price and quantity, total expenditure/revenue, consumers' and producers' surplus.** 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. Total expenditure/revenue decreases from $P_0 a Q_0 0$ to $P_{max} b Q_s 0$.

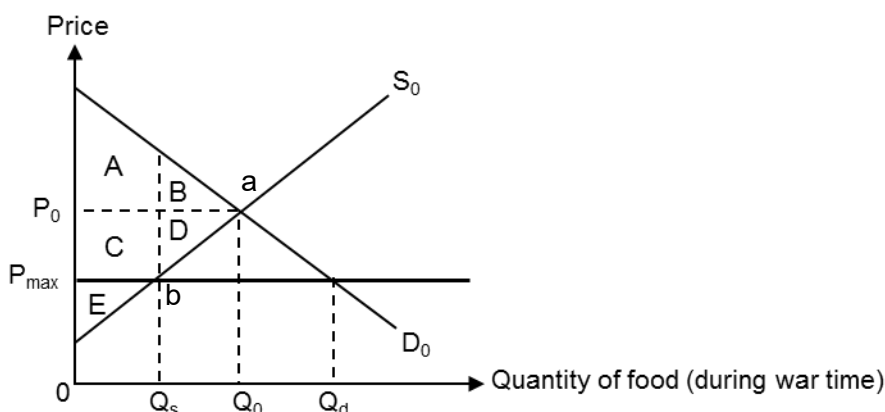


Figure 18: Effect of maximum price on welfare

- 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 Q_s can be traded). More intuitively, those consumers who are able to obtain food at P_{max} tend to benefit from the price ceiling, but the welfare of consumers as a collective group is uncertain as there is a gain in consumers' surplus of area C, but a loss of consumers' surplus of area B.

- 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 which means that the difference between the actual price producers receive and the minimum price they must receive has fallen. The quantity sold has also 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 because 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.

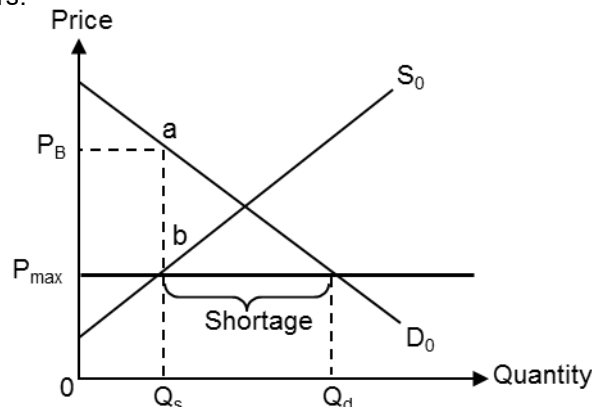


Figure 19: Black market resulting from price ceiling

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

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 P_{max} .

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 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.

Key Point:
Quotas are set below the equilibrium quantity.

An example of 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 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, a 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^* . Total expenditure/revenue changes from P_0Q_0 to P_1Q^* . Whether total expenditure/revenue rises or falls depends on PED.

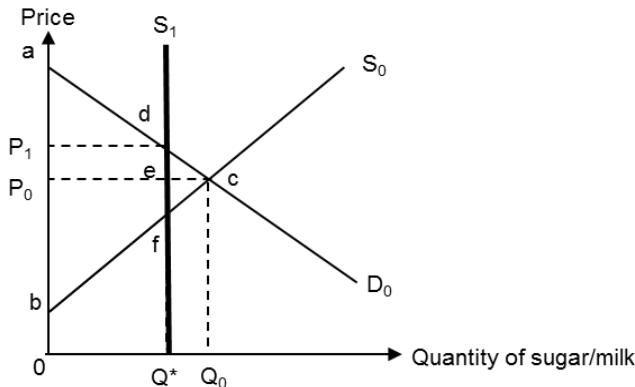


Figure 18: Effect of production quota on market for sugar/milk

- 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 must pay rose from P_0 to P_1 which means that the difference between the maximum price consumers are willing and able to pay and the actual price they pay has fallen. In addition, 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 $[-(\text{Area } P_0P_1dc)]$ + change in producer surplus (Area P_0P_1de - ecf). There is an overall change in society's welfare of $-(\text{Area } cdf)$.

Sectional Summary

- Government may intervene via 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 tax authorities directly by economic agents with the income/wealth. Direct taxes decrease demand.
- Subsidies are cash transfers 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.
- Price controls refer to the setting of minimum or maximum prices by the government. For a minimum price (i.e. price floor) to be effective, it must be set above the market equilibrium price. For a maximum price (i.e. price ceiling) to be effective, it must be 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).

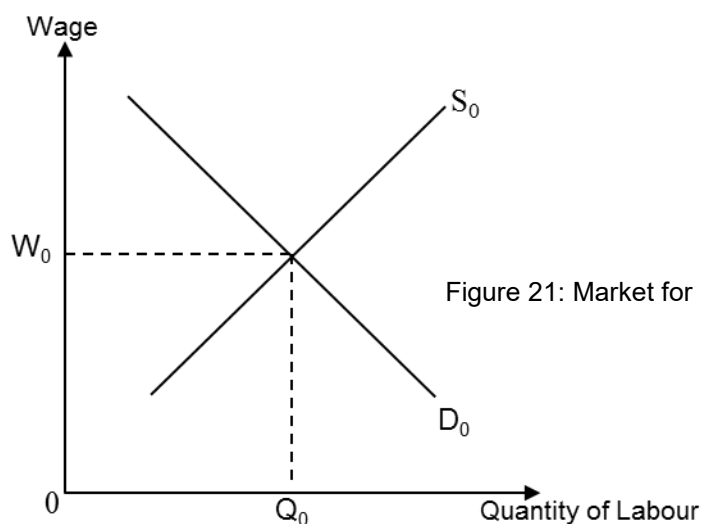
3. Labour Market

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 are sellers while firms are buyers**. 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.



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

Since the **demand for labour is derived from the demand for final goods and services**, a rise in demand for final goods and services will increase the demand for labour. In other words, any factor increasing demand for goods and services will indirectly increase the demand for labour.

- Price of final goods and services

When the price of final goods and services increase, quantity supplied of the good/service (Law of Supply) increases. In order to raise quantity supplied, firms will have to employ more labour to produce a greater amount of the final good/service, therefore, increasing the demand for labour.

- Productivity of labour

Labour productivity is often defined as the amount/level of output that is obtained from an employee. An increase in productivity of labour means that each unit of labour employed can bring in more revenue for the firm. Therefore, firms will increase the demand for labour as well.

- 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 of capital goods, then firms will replace the relatively more expensive 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.

- Changes in technology/method of production

Technological advancements may augment the productivity of labour, which increases the demand for labour. However, technology affects different types of labour differently. For instance, 3D-printing will increase the demand for specialized engineers but will reduce the demand for assembly-line workers. Similarly, chatbots may reduce the need for some customer service representatives but increase the demand for developers familiar with Natural Language Processing (NLP).

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 for that 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. doctors are required 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 pleasantness of the work environment, job satisfaction, security, holidays, perks and other fringe benefits. These affect the overall attractiveness of a job which in turn 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). Wages will be driven downwards until the surplus is eliminated at the new wage rate W_1 , where employment has risen to Q_1 .

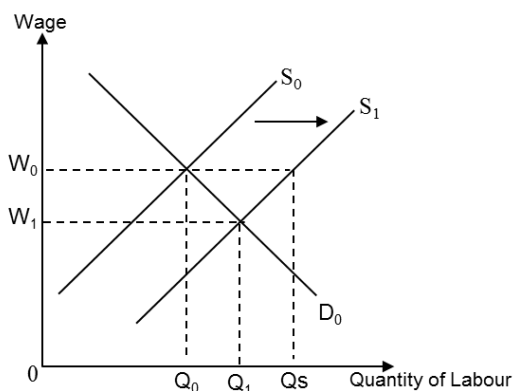


Figure 19: Labour Market Wage Determination

The falling wage **acts as a signal and an incentive**. It signaled to firms there was surplus in the labour market, and provided them with an incentive to hire more labour. Thus, firms increase quantity demanded along the labour demand curve from Q_0 to Q_1 . The lower wage acts as a signal to workers, and incentivizes workers to decrease quantity supplied along the new supply curve S_1 from Q_s to Q_0 , offering less of their services at the lower wage. With firms and workers responding to price signals and incentives, there is 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 elasticity 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 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, supply of surgeons is price-inelastic as it takes years to train a surgeon in medical school and the quantity of surgeons supplied cannot respond easily to wage changes. Therefore, when there is an increase in demand for surgeons and a large shortage is 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, demand for lawyers is a price inelastic due to the lack of alternative legal services offered by lawyers. 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 shortage will be created since quantity demanded by firms remains but quantity supplied falls at the given wage rate. A large rise in wages will be required for the market for lawyers to reach equilibrium again.

- Government intervention

The government can also intervene in the labour market to influence the wage rate. Minimum wages laws 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.

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

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 .

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

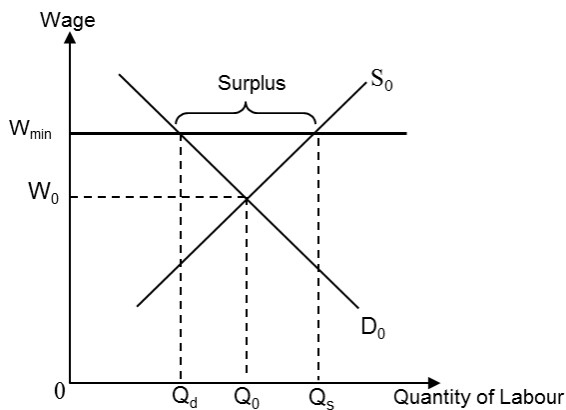


Figure 19: Effect of minimum wage on labour market

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 $Q_s - Q_d$. 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 unemployment increases.**

Furthermore, with higher wage rate imposed, firms would face higher labour costs. In the long run, firms might develop and switch to labor-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.

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.

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

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.

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).

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 ($PED = \infty$). The reason for this differing elasticity can be demonstrated using the equation for a straight-line demand curve:

$$Q = a - bP$$

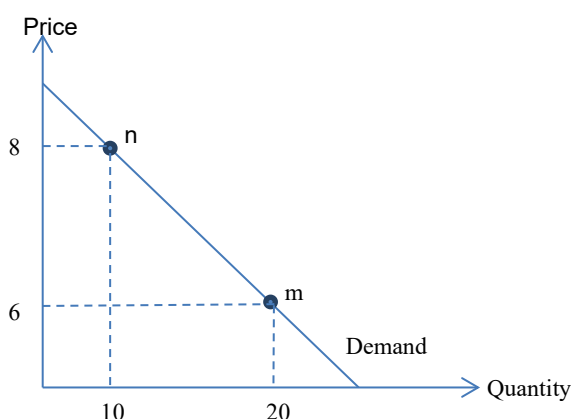
The term ' $-b$ ' would give the slope of the demand curve if we were to plot Q on the vertical axis and P on the horizontal. Since we plot them the other way around, the term ' b ' gives the inverse of the slope as plotted. The slope of the curve as plotted is given by $\frac{dP}{dQ}$; the inverse of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

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.

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,

$$PED = -5 \left(\frac{8}{10} \right) = -4$$

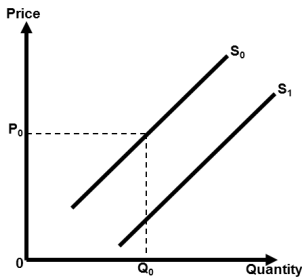
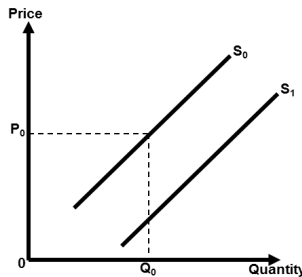
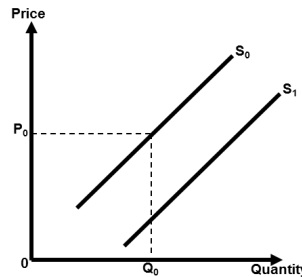
At point m, however, $\frac{P}{Q} = \frac{6}{20}$. Thus,

$$PED = -5 \left(\frac{6}{20} \right) = -1.5$$

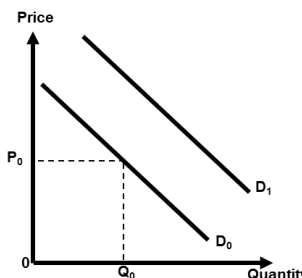
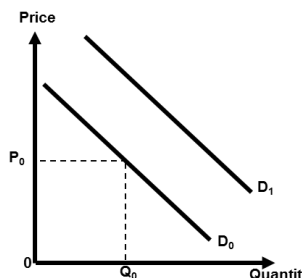
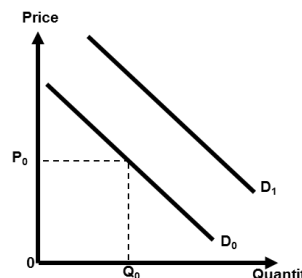
Source: Sloman, J. et.al (2015). Chapter 3.1 Elasticity

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:  Fall in price from _____ to _____ will cause _____ rise in quantity from _____ to _____.	If demand is price elastic:  Fall in price from _____ to _____ will cause _____ rise in quantity from _____ to _____.	Comparing both:  Fall in price is _____ when demand is price inelastic compared to when demand is price elastic.
Total revenue _____.	Total revenue _____.	

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

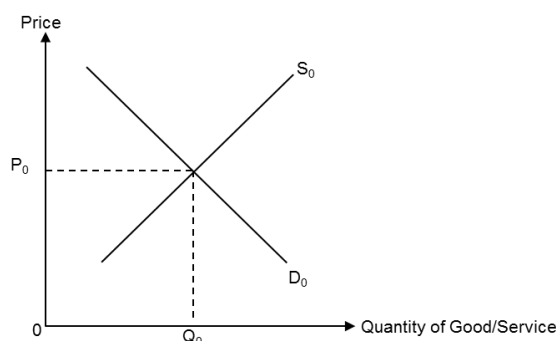
If supply is price inelastic:  Rise in price from _____ to _____ will cause _____ rise in quantity from _____ to _____.	If supply is price elastic:  Rise in price from _____ to _____ will cause _____ rise in quantity from _____ to _____.	Comparing both:  Rise in price is _____ when supply is price inelastic compared to when supply is price elastic.
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Appendix 3 – 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.

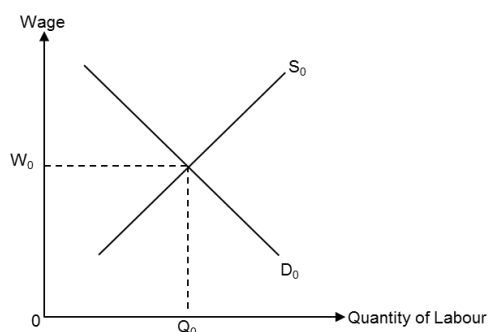
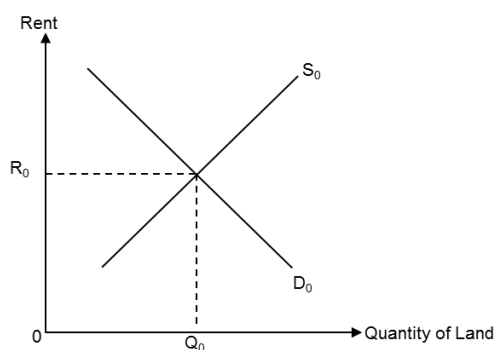
Goods and Services Market (Product Market)

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.

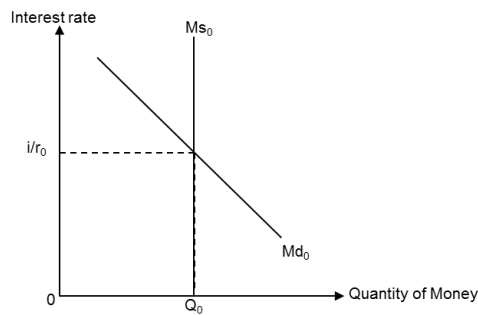
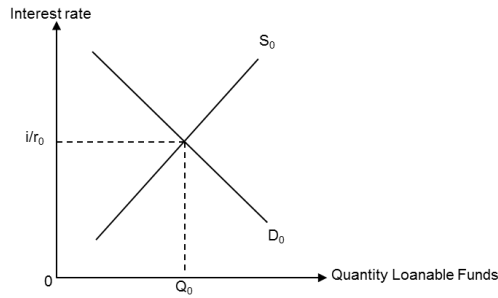


Money Market (Financial Market)

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 4 – 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 wage 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:

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

The wage 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.
- Nature of Labour Contracts/Bonds – This affects the mobility of the labour during the bond period.

Appendix 5 – Wage Determination in Singapore

In Singapore, wages are largely determined by demand and supply levels existing in each labour 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.

**RAFFLES INSTITUTION
YEAR 5 H2 ECONOMICS 2025
PRICE MECHANISM AND ITS APPLICATIONS (PARTS 1 & 2)**

SUPPLEMENTARY WORKSHEETS

1. (Refer to Part 1, Section 1 of your lecture notes)

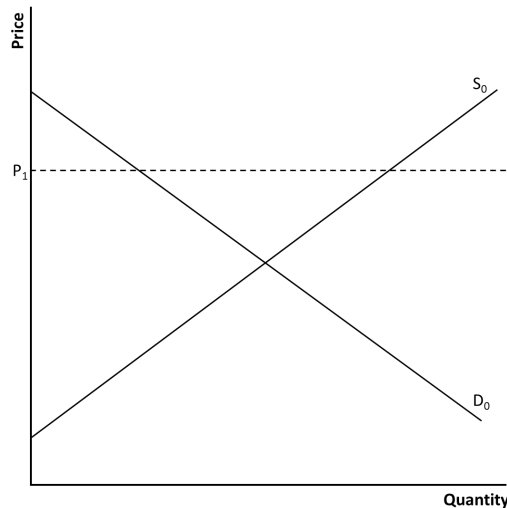


Figure 1

- i) Explain what is meant by free market equilibrium?
- ii) State the condition for a free market to be in equilibrium & identify the free market equilibrium outcome in Fig 1.
- iii) State whether the market is in equilibrium at price level, P_1 . Explain why so.
- iv) Explain in a step-by-step manner, the process by which such a free market will move towards the free market equilibrium.

2. (Refer to Part 1, Section 2 of your lecture notes)

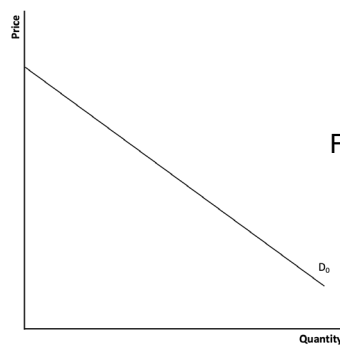


Figure 2

- i) Explain what is meant by a downward sloping demand curve.

- ii) Explain why the demand curve is downward sloping.
- iii) Explain how rational decision making by consumers results in a downward sloping demand curve.
- iv) Illustrate an “increase in demand” in Fig 2. How can you describe such a rightward shift of the demand curve in words?
- v) Suggest 3 possible reasons which can cause the above to take place.

3. (Refer to Part 1, Section 3 of your lecture notes)

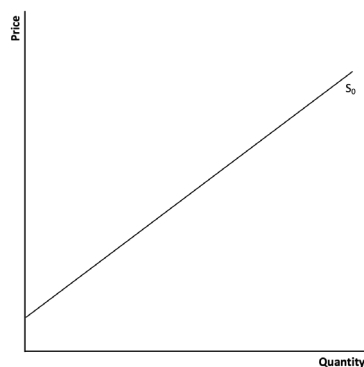


Figure 3

- i) Explain what is meant by an upward sloping supply curve.
- ii) Explain why the supply curve is upward sloping.
- iii) Explain how rational decision making by producers results in an upward sloping supply curve.
- iv) Illustrate a “decrease in supply” in Fig 3. How can you describe such a leftward shift of the supply curve in words?
- v) Suggest 3 possible reasons which can cause the above to take place.

4. (Refer to Part 1, Section 4 of your lecture notes)

Fill in the following table. Choose “↑”, “↓” or “?”

Change/s in D/S	Change in Eqm P	Change in Eqm Q
↑ D, S unchanged		
↓ D, S unchanged		
D unchanged, ↑ S		
D unchanged, ↓ S		
↑ D, ↑ S		
↑ D, ↓ S		
↓ D, ↑ S		
↓ D, ↓ S		

5. (Refer to Part 1, Section 5 of your lecture notes)

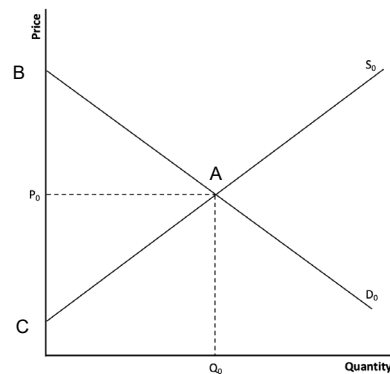
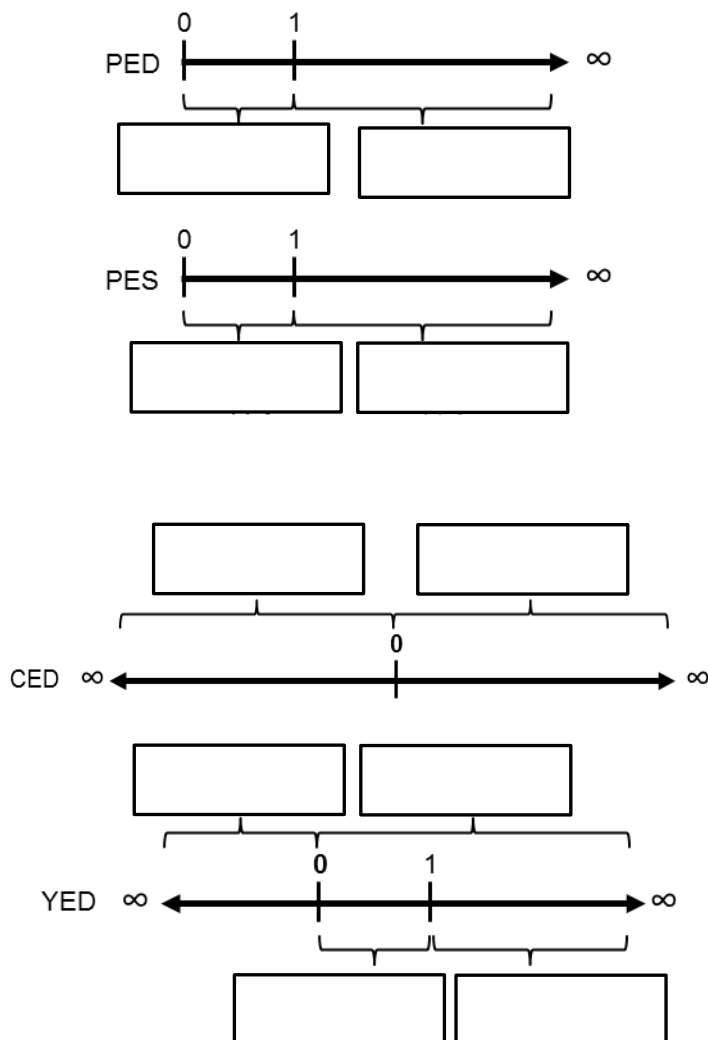


Figure 4

- i) Define consumer surplus.
- ii) Identify the area that represents the consumer surplus in Fig 4.
- iii) Referring to the diagram, identify 3 factors that affect the size of consumer surplus.
- iv) Define producer surplus.
- v) Identify the area that represents the producer surplus in Fig 4.
- vi) Identify 3 factors that affect the amount of producer surplus enjoyed by producers.
- vii) Identify the area that represents society's welfare in Fig 4.

6. (Refer to Part 2, Section 1 of your lecture notes)

Fill in the blanks.



7. (Refer to Part 2, Section 2.2 of your lecture notes)

- Illustrate how an **indirect tax** of \$0.30/can of soft drink can be represented in Fig 5.
- Analyse the effects of such an indirect tax on equilibrium P, equilibrium Q, TR, TE, CS, PS.

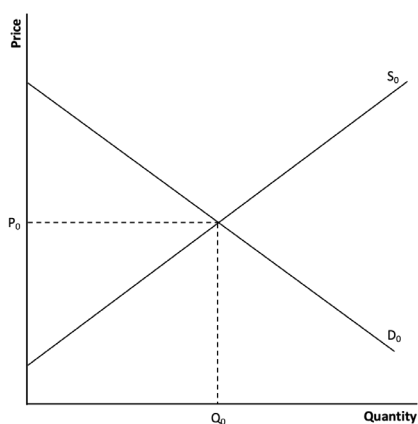


Figure 5: Market for soft drinks

- iii) Illustrate how a **per unit subsidy** to agricultural producers can be represented in Fig 6.
- iv) Analyse the effects of a per unit subsidy on equilibrium P, equilibrium Q, TR, TE, CS, PS.

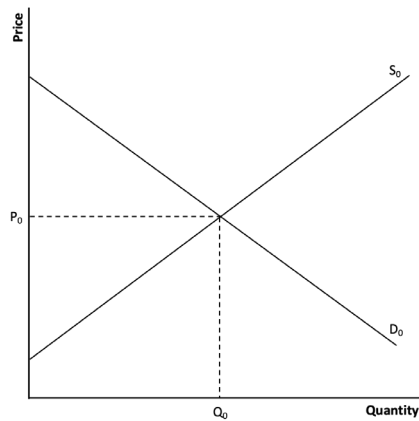


Figure 6: Market for agricultural products

- v) Illustrate how a **direct subsidy** of \$50 CDC vouchers affects the market for hawker food in Fig 7.
- vi) Analyse the effects of such a direct subsidy on equilibrium P, equilibrium Q, TR, TE, CS, PS.

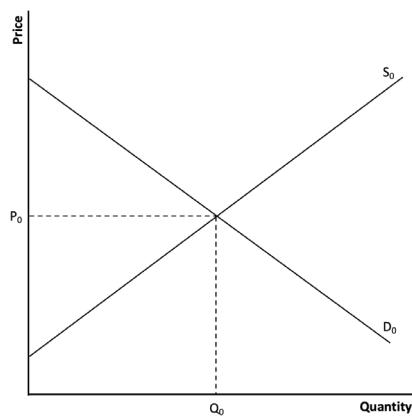


Figure 7: Market for hawker food

8. (Refer to Part 2, Section 2 of your lecture notes)

Illustrate the following types of government intervention in the free market in the below Figs, and analyse its effects on equilibrium P, equilibrium Q, TR, TE, CS and PS:

- i) **Quota**

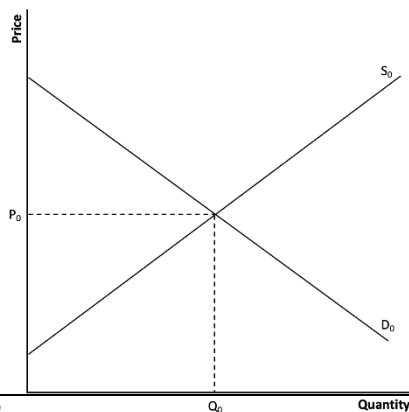


Figure 8

ii) **Price Ceiling**

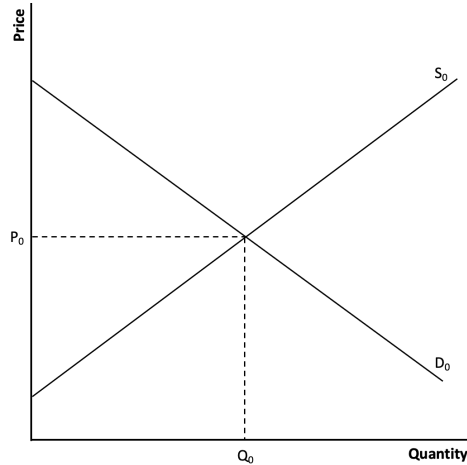


Figure 9

iii) **Price Floor**

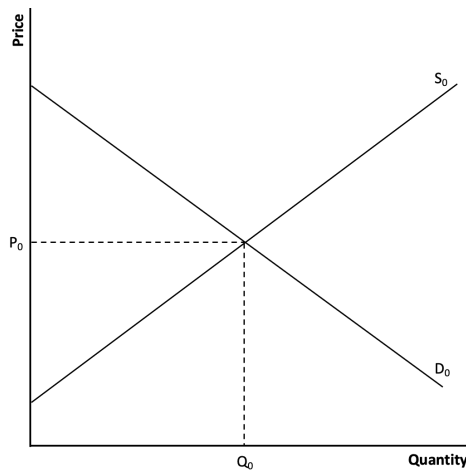


Figure 10

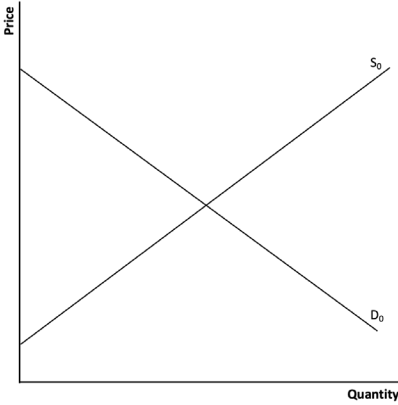
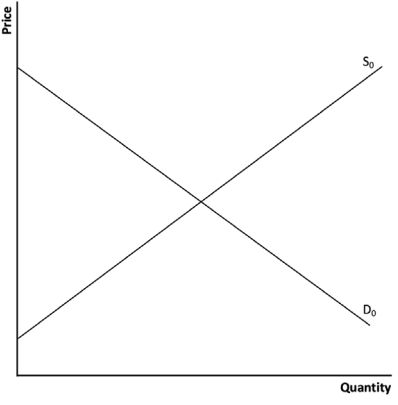
Section A: Short Structured Questions

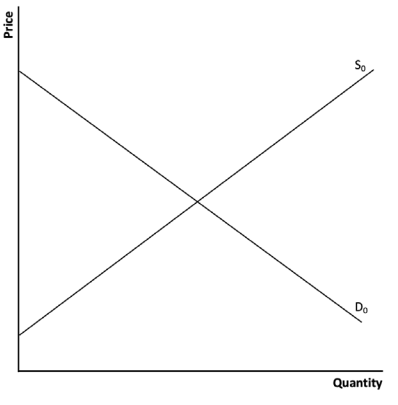
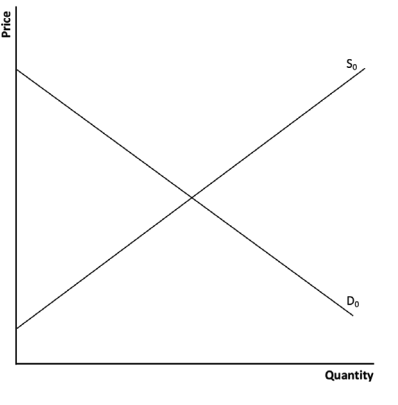
- 1) **Analyse the effects of the following changes on the poultry market.** Distinguish between a shift of and a movement along the supply curve and indicate the direction of the shift or movement.
 - (a) The demand for poultry increases.
 - (b) Imported meats, including poultry, from United States are allowed into the country because 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: Consider the **extent** to which the changes in supply or quantity supplied occur, and give reasons to support your evaluation.)

2) **Market for Coke and Pepsi**

- i) State the relationship between Coke and Pepsi.
- ii) State and explain the CED value between Coke and Pepsi.
- iii) Analyse the effects of the following events in the Coke market on the Pepsi market.

Event 1: Coke workers successfully negotiate a wage increase	Event 2: Successful Coke advertising campaign appealing to the taste and preference of sugared carbonated drinks consumers
<u>Coke Market</u>  a) Illustrate how an increase in wages of Coke workers affects the Coke market in the above Figure. b) State the changes in equilibrium P and Q in the Coke market.	<u>Coke Market</u>  a) Illustrate how a successful Coke advertising campaign affects the Coke market in the above Figure. b) State the changes in equilibrium P and Q in the Coke market.

<u>Pepsi Market</u>  c) Explain how events in the above Coke market affects the demand for Pepsi. d) State the changes in equilibrium P and Q in the Pepsi market.	<u>Pepsi Market</u>  c) Explain how events in the above Coke market affects the demand for Pepsi. d) State the changes in equilibrium P and Q in the Pepsi market.
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Section B: 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?

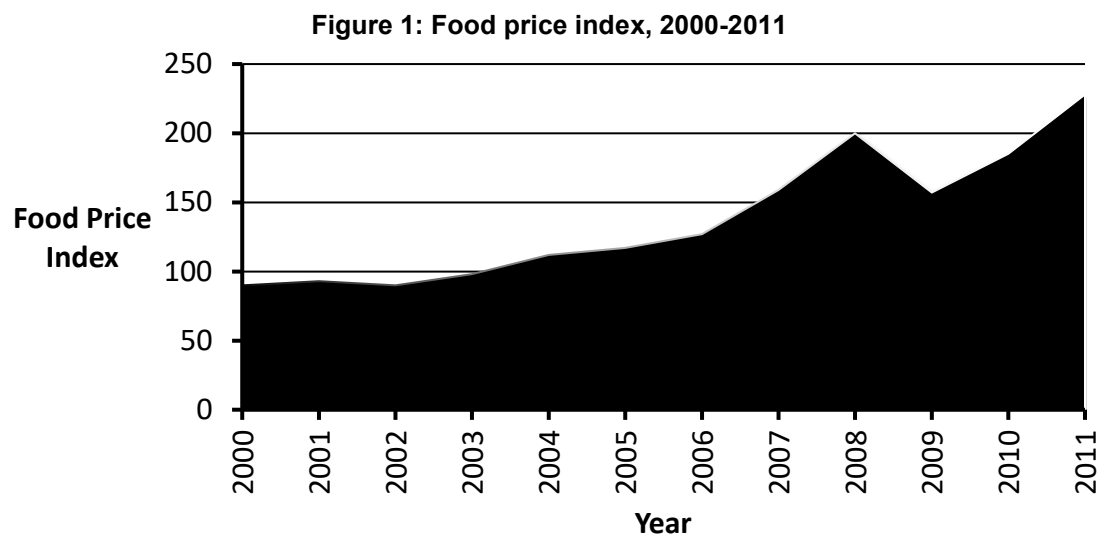
If 9 billion people are to be fed in 2050, countries that produce a miserable one tonne per hectare will have to produce two, the vast amount of food wasted on poor countries’ farms – a third or more of the total – must be saved; and plant breeders will have to reverse the long decline in yield growth. 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



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. [4]
- (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? [5]
- (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 from 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 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 than that for UK destinations. [2]
 - (ii) why the income elasticity of demand for business flights to UK destinations is higher than that for non-UK destinations. [2]
- (c) Explain the likely value of the cross-elasticity of demand between high-speed rail travel and air travel. [2]
- (d) Explain **either** one demand **or** one supply factor that has led to a rise in VFR travel. [2]

Question 3

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

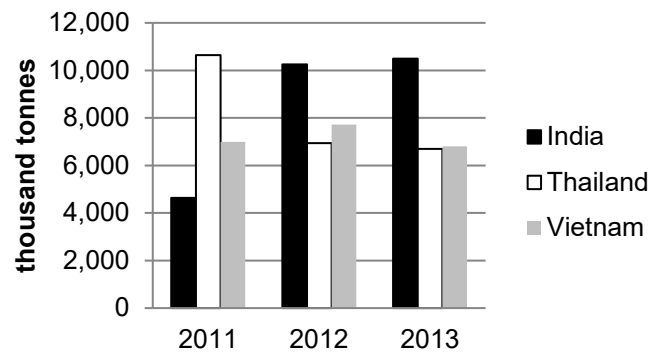
Table 1: Export Prices for Rice (US\$/tonne)

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

*Export price not available as India did not export 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]

Section C: Essay Questions

1. Explain how economic theory suggests consumers act rationally to decide whether or not to buy a bicycle, and how producers of bicycles act rationally to determine their level of output. [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 demand and supply factors on milk farmers' revenue. [10]
 - (b) Discuss the impact of the falling milk prices on two related markets. [15]

Variant to Question 2

Bad weather and falls in consumer incomes can have different impacts on the prices of agriculture products such as vegetables, rice and grain.

- (a) Explain the different impacts on the price of vegetables due to bad weather and falls in consumer incomes. [10]
- (b) Discuss the effectiveness of different measures that might ensure stability of food prices to consumers. [15]

3. 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]

Variant to Question 3

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.

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

4. Concerns about future shortages of water resulted in Singapore's national water agency, PUB, increasing the price of water by 30% by 2017. By 2060, Singapore's total water demand could almost double.
 - (a) Explain why a shortage of water might still exist after the rise in the price of water. [10]
 - (b) Discuss whether the government policy of increasing the price of water is the only effective way to overcome future water shortages. [15]

Variant to Question 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]

Section D: Further Reading

Article 1: Caffeine hit: The rise and rise of Irish coffee culture <i>What are some factors that have driven up demand for coffee in Ireland? How might Irish coffee roasters respond to increased competition in the market?</i>	
Article 2: Coffee drinkers in Ireland jolted by rising cost of caffeine hit <i>How does the imposition of VAT (which is a type of indirect tax) affect the market for coffee in Ireland? Coffee chains have passed on the cost increased to retailers. What might this suggest about the likely PED for coffee?</i>	
Article 3: US crude rises 1.9%, settling at \$47.96, as trade talks and supply cuts boost oil prices <i>Use a DD-SS diagram to explain how the changes in the crude oil market affected the price of crude oil.</i>	
Article 4: Tobacco tax hike will see prices of cigarettes go up by about \$1 but experts say smokers may still be undeterred <i>"High prices can stop young people from taking up smoking and encourage current smokers to quit or smoke less, especially those with limited disposable incomes," What does this suggest about the PED for cigarettes and its usefulness to cut back smoking?</i>	
Article 5: Price controls and scarcity force Venezuelans to turn to the black market for milk and toilet paper <i>Use a DD-SS diagram to explain how price controls resulted in shortages for milk and toilet paper. Who gains and who loses because of price controls?</i>	
Article 6: They Said Seattle's Higher Base Pay Would Hurt Workers Why Did They Flip <i>Why do minimum wages affect workers differently?</i>	