

# **Economics**

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# Preface

## About

These notes review the Singapore-Cambridge GCE A-Level H1 Economics ([8843](#)) syllabus.

Candidates taking this subject sit for the H1 Economics Paper 1, which comprises of 2 case studies, each consisting of 2 to 3 pages of data presented in textual, numerical or graphical form. Each case study will present contemporary multifaceted economic issues or policies, which may be from one or more themes in the syllabus. The data for each case study will be followed by 7 to 8 part-questions, including sub-parts. These questions will require candidates to apply relevant economic concepts, theories and principles in analysing, synthesising and evaluating economic issues, perspectives or policies, with reference to the data provided. About 16 marks of each set of case study questions will be allocated to data response questions, and about 24 marks will be for higher-order questions.

## Acknowledgements

These notes are largely adapted from the notes provided by Dunman High School's Economics Department.

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## **Part I.**

# **The Central Economic Problem**

# 1. Scarcity, Choice and Resource Allocation

## 1.1. Scarcity

**Definition 1.1.** *Scarcity* is the situation of limited resources in relation to unlimited wants.

**Definition 1.2.** *Resources* are the inputs used in the production of the things we want. The resources used in production are called **factors of production**.

The total quantity of all resources an economy has at any one point determines the maximum possible output that economy can produce. Resources are limited because the quantity of factors of production are always fixed at any given period of time.

Factors of production can broadly be classified into 4 types:

- **Capital**
  - Man-made factors used in the production of other goods and services.
  - Types
    - \* Fixed capital – machinery and buildings
    - \* Infrastructure AKA social overhead capital – roads & rail network, telecommunication network, air & sea ports, etc.
- **Entrepreneurship**
  - The factor of production that assumes the risk and faces the uncertainty of combining the other 3 resources and engaging in production.
- **Land**
  - Encompasses all the natural resources that are available from nature, and can be renewable or non-renewable. (e.g. minerals, trees, resources that can be harvested from oceans and even the climate that is favourable to grow certain crops in)
- **Labour**
  - Includes all the productive contributions made by the physical and mental human effort.
  - The quantity of labour available for an economy consists of all those who are willing and able to work.

**Definition 1.3.** *Goods* are defined as all things from which individuals derive satisfaction. *Economic goods* are scarce goods for which the quantity demanded exceeds the quantity supplied at zero price.

**Definition 1.4.** *Services* are tasks that are performed for someone else. (e.g. laundry, internet access, teaching)

## 1.2. Resource Allocation

In a world of scarcity, the society, as a whole, is limited by the amount of resources it has to produce the goods and services to satisfy all these wants. **Choices** are hence inevitable, and must be made in the allocation of resources between different uses.

Fundamental questions of resource allocation:

- **What** and **how much** to produce?
- **How** to produce?
- **For whom** to produce?

## 1.3. Opportunity Cost

**Definition 1.5.** The *opportunity cost* of any activity is the value of the next-best alternative forgone.

The scarcity of resources puts a limit on how much goods and services the economy can produce to satisfy wants and contribute to the people's standard of living. Every time we make a choice, we are trading off the use of that resource for one or more alternative uses. The extent of the trade off is represented by the opportunity cost.

## 1.4. Production Possibility Curve (PPC)

**Definition 1.6.** The *production possibility curve (PPC)* of the production possibility frontier (PPF) is a graph that shows the maximum possible output combinations that the economy can produce in a given period of time (e.g. a year).

The PPC is a boundary or frontier because it shows the maximum production possible. It separates the attainable combination of goods from the unattainable.

## Assumptions

The relevant assumptions of the PPC model include:

- 2 goods
- Resources are fully and efficiently employed.
- Within a given period of time, the quantity and quality of the resources remain fixed. Technology also remains constant.

## Graphical Illustration

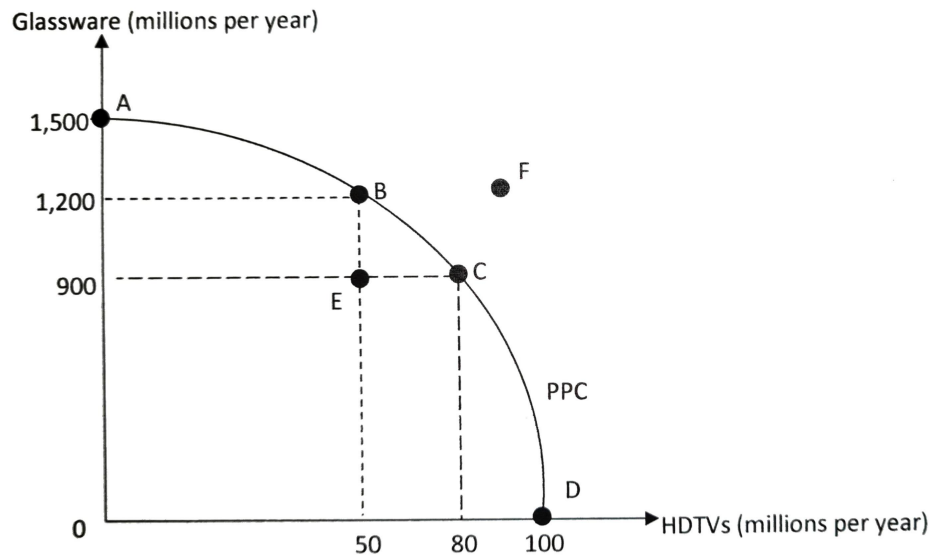


Figure 1.1.: Production Possibility Curve

### Interpretation

Figure 1.1 shows the various maximum possible output combinations of glassware and HDTVs that can be produced with the available factors of production and production technology in a given time period of 1 year.

Represented by point A on the PPC, if all the resources were devoted solely to the production of glassware, the country produces 1500 million units of glassware (output of HDTVs = 0). Similarly, represented by point D, if all the resources were devoted solely to the production of HDTVs, the country produces 100 million units of HDTVs (output of glassware = 0).

In between points A and D are the maximum possible combinations of output when the resources are shared between the 2 industries. For example, at point B on the PPC, the country produces 1200 million units of glassware and 50 million units of HDTVs.

## What the PPC tells us about scarcity, choice and opportunity cost

### Scarcity

Scarcity is illustrated on the PPC as only combinations of goods within and on the PPC are attainable. Points beyond the PPC are unattainable due to limited resources.

- Points *on* the PPF (A, B, C, D)
  - Production can take place on the frontier with the economy producing the maximum possible output only when:
    - \* Resources are fully-utilised (fully-employed) and/or
    - \* There is productive efficiency – using its given resources to produce the maximum possible output. It is hence impossible to increase the production of one good without reducing the production of the other.



- Points *within* the PPF (E)
  - Combinations within the frontier imply that resources are:
    - \* Under-utilised (under-employed/unemployed) and/or
    - \* Misallocated and the economy is productively inefficient – at point E, output is not maximised. It is hence possible to increase the production of one good without reducing the production of the other (moving from point E to any point on the segment of the PPC bounded by points B and C).
- Points *outside* the PPC (F)
  - Combinations beyond the boundary of the PPC are unattainable with the economy's given resources and current state of technology.

## Choice

Choice is illustrated via the choice between the different points on the PPC, depending on the economy's relative preference for the two goods.

## Opportunity Cost

Opportunity cost is illustrated as the trade-off between the 2 goods and computed as the slope of the PPC.

The PPC is *downward sloping*, illustrating the fact that scarce resources have alternative uses and the trade-off as we move resources from one industry to the other.

The PPC is drawn *concave to the origin* (bowed outwards). The gradient of the PPC increases in steepness as we move along the horizontal axis, indicating that to produce an additional unit of HDTV, an increasing amount of glassware has to be sacrificed.

The *law of increasing relative cost*/*law of increasing opportunity cost* states that when society takes more resources and applies them to the production of any specific good, the opportunity cost increases for each additional unit produced.

The reason why the law of increasing relative cost works is because certain resources are better suited for producing some goods than they are for other goods. Generally, resources are not perfectly adaptable for alternative uses.

- For instance, to increase the production of HDTV, resources have to be diverted away from the production of glassware. Initially, producers will draw on the resources that are most suited to the production of HDTV and least suited to the production of glassware (e.g. workers with engineering and technical training). Hence, the economy does not have to give up that many units of glassware to produce the first batch of HDTVs.
- However, if the production of HDTV continues to increase, firms will have to draw on the remaining pool of resources, which are less suited to the production of HDTV. Hence, more resources will be required in the production of the next batch of HDTVs, resulting in a greater loss in glassware production.
- Eventually, firms will have to draw on the resources best suited to glassware production and least suited to HDTV production such as the artisans, professional glass blowers and designers. The loss of output in glassware production will hence be the greatest in producing the last batch of HDTVs.

## Effect of a Recession on the PPC

When firms experience falling demand for their goods and services, they scale back production and lay off workers. Among the workers who are retrenched, some are able to find another job, though not necessarily their ideal job (e.g. accepting a position below what they are qualified to do/going on part-time) – under-employed workers. Others who cannot find alternative employment remain unemployed.

This is represented by a movement from a point on/close to the PPC to a point within the PPC. Referring to Figure 1.2, this is depicted as a movement from point A on the PPC to point B, a point within the PPC. **Actual output falls but potential output does not.** Resources do not get destroyed and technology does not regress. The potential to produce has, therefore, not diminished. The situation is just one of the resources not being put to use. Once the economy recovers from the recession, resources will be re-employed to produce goods and services again.

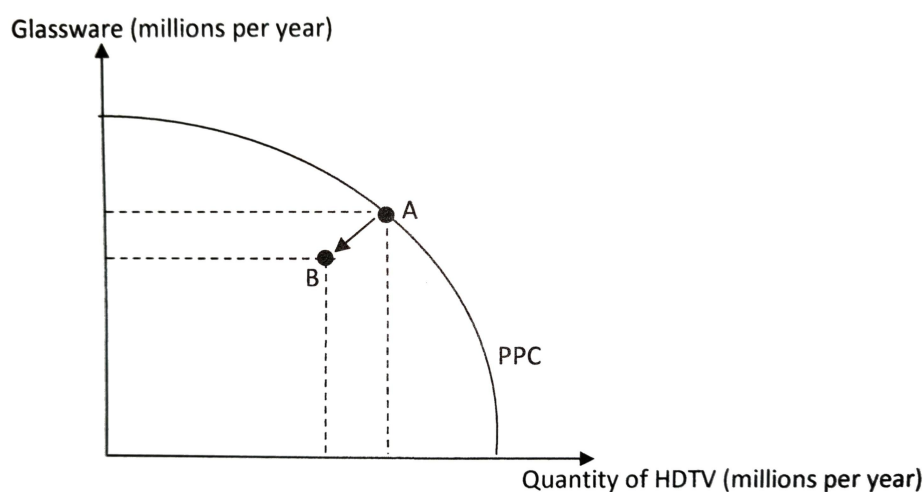


Figure 1.2.: Effect of a Recession

## Effect of Changes in the Quantity and/or Quality of Resources & Technology

Take the enhancement of programmes such as the Productivity Solutions Grant (PSG) and the SkillsFuture Credit Top-up as an example.

Firms are able to tap on the government grant to adapt "productivity solutions" (e.g. purchase robots). In doing so, they are in fact adding to the economy's capital stock – increasing factor quantity, capital being 1 of the 4 factors of production. The use of robots also has a productivity enhancing effect, enabling more output to be produced per worker. Together, the increase in factor quantity and quality bring about an expansion in the economy's productive capacity, shifting the entire PPC outwards. The new efficient frontier is now  $PPC_1$ , with points inside  $PPC_1$  as inefficient and points outside  $PPC_1$  unattainable. Initial efficient points on  $PPC_0$  are now regarded as inefficient.

However, there may also be a pivotal shift in the PPC. Assuming that a technological improvement has occurred in the glassware industry without any direct impact on HDTV, there will be a pivotal shift of the PPC, with the maximum possible output for glassware increasing and that for HDTVs remaining the same.

#### *1.4. Production Possibility Curve (PPC)*

In any case, when the PPC shifts outwards as a result of an increase in the quantity of resources, an improvement in the quality of resources and the advancement in technology, potential economic growth is said to have taken place.

## 2. Decision-making Process of Economic Agents

The scarcity of resources necessitates choice and leads to decision making by economic agents in various economic processes – production, consumption, distribution.

**Definition 2.1. *Economic process*** refers to activities through which goods and services aimed at satisfying human needs and wants are produced, distributed and used.

One of the fundamental characteristics of activities defined as economic processes is that they involve relations between various agents.

**Definition 2.2. *Economic agent*** refers to a person or legal entity that plays an active role in an economic process.

The groups of economic agents include:

- **Households**, as consumers of goods and services
- **Firms**, as producers of goods and services intended for sale to generate profit
- **Government**, which in addition to fulfilling its political responsibilities and role of economic regulation, produces principally non-market services (possibly goods) for individual or collective consumption and redistributes income and wealth

These agents interact with each other in a system to determine the outcome of resource allocation.

**Regardless of the group of economic agent, the decision-making process includes the same key aspects, as follows.**

### 2.1. Rationality Assumption

Individuals act as if motivated by self-interest and respond predictably to opportunities for gain, making use of available information. The rationality assumption of economics is simply stated as we assume that individuals do not intentionally make decisions that would leave them worse off.

This requires individuals to possess:

- Unlimited information-processing capabilities – having the ability to weigh the benefits and costs of possible decisions.
- Unbounded willpower (i.e. complete self-control) – having the self-control to make right choices consistent with their goals.

*These conditions have come under criticism (behavioural economics – cognitive biases).*

## 2.2. Goal Orientation

Rational decisions are goal-oriented – decisions made are consistent with the goal of the economic agent:

- Consumers are assumed to act in a way such that their utility is maximised.
- Firms seek to maximise their profits/minimise their losses.
- Governments pursue a range of policy objectives:
  - Microeconomic objectives: efficiency and equity
  - Macroeconomic objectives: inclusive and sustainable growth, full employment/low unemployment and price stability
  - Ultimate goal: improve the standard of living

## 2.3. Constraints

Due to the fundamental problem of scarcity, choices have to be made. Hence, economic agents consider the constraints that they are currently experiencing to determine the choices available to them.

**The following are sources of constraints.**

### Budget or the Availability of Funds

For **consumers**, not all combinations of goods and services they desire are available as choices. As consumers strive for the highest level of utility, they face budget constraints. With limited income, they need to decide how best to allocate their budget to maximise their utility.

For **governments**, not all projects that would improve society's welfare is available. Governments too face budget constraints. Government spending is constrained by the amount of tax revenue it collects. While the government, like firms, can take on loans, there is a limit to how much it is able to borrow without pushing up interest rates and adding to debt, financing burden that would undermine future living standards. The government has to decide how to allocate its budget to competing social, economic and security needs.

### Government Regulations

Individuals and organisations are bounded by the laws of the land. For **consumers**, government regulations such as age limit on tobacco and alcohol consumption, bans or legislation on certain types of drugs, etc. would determine what individuals can or cannot purchase.

### Political Support

Government policy-making is subjected to the political process – government policies need political support.

## 2.4. Information

For economic agents to make good decisions, they need to have the relevant information, including information on:

- All options/alternatives
- Constraints – separate the feasible from the unfeasible
- Benefits and costs of each option

The better the quality of the information – accurate, complete, timely – the better the decision-making in terms of making the highest net benefit.

In reality, quality information, rather than being readily available, is often difficult and costly to obtain. For instance, a consumer, in deciding the best brand and model of laptop to purchase, needs to devote time to research on the brands and models that are available in the market, the specifications of each model, the prices offered by various merchants, etc. In other words, expending time to gather information to make better decisions is part of the cost of decision-making. Apply the marginalist principle, economic agents will continue to source for information only for as long as the expected marginal benefit of data gathering  $\geq$  expected marginal cost.

## 2.5. Weighing the Benefits and Costs

Having narrowed down the options/alternatives to those that are permitted within the constraints, economic agents weigh the benefits and costs of each cost of action to arrive at the best outcome.

### Marginalist Principle

Rational consumers and producers, driven by their self-interest (utility/profit maximisation), would consume/produce up to the point where

$$\text{marginal private benefit (MPB)} = \text{marginal private cost (MPC)}$$

of the last unit consumed/produced.

### Application to Consumers

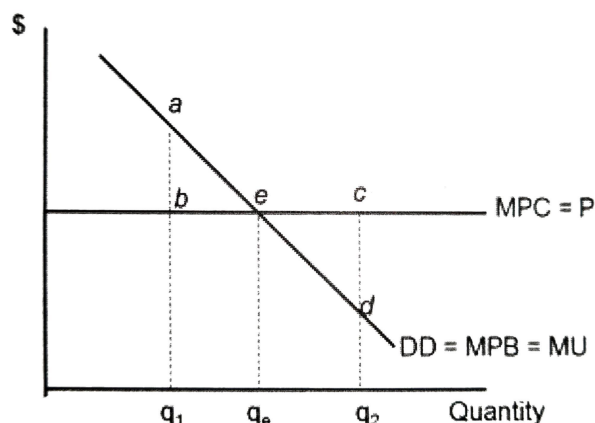
The aim of rational consumers is to maximise their utility/satisfaction from the consumption of goods and services within their given budgets. Referring to [Figure 2.1](#), the rational consumer will consume up to  $q_e$  units where, for the last unit consumed,

$$\text{marginal utility/consumer's MPB} = \text{price/consumer's MPC}$$

At a quantity below  $q_e$ , say at  $q_1$ , the last unit consumed brings the consumer more benefit/utility ( $a_{q_1}$ ) than it costs the consumer ( $b_{q_1}$ ). The rational consumer should hence increase consumption to increase net utility.

At a quantity above  $q_e$ , say at  $q_2$ , the last unit consumed brings the consumer less benefit/utility ( $d_{q_2}$ ) than it costs the consumer ( $c_{q_2}$ ). The rational consumer should hence decrease consumption to increase net utility.

At  $q_e$ , where marginal utility = price, the last unit consumed brings the consumer as much utility as it costs the consumer in terms of the value of the alternative good forgone. At this point, the consumer cannot increase utility further by increasing/decreasing the units consumed – utility is maximised.



**Figure 2.1.:** Rational Decision-making at the Individual Consumer Level

### Application to Governments

Governments, in pursuit of maximising society's net welfare, would steer consumption/production up to the point where

$$\text{marginal social benefit (MSB)} = \text{marginal social cost (MSC)}$$

of the last unit consumed/produced.

Referencing **Figure 2.2**:

At output below  $Q_e$ , say at  $Q_1$ , the last unit consumed/produced adds more to society's benefit ( $aQ_1$ ) than it does to society's cost ( $bQ_1$ ). Society's welfare can be increased by raising consumption/production from  $Q_1$  to  $Q_e$ , as it would add as much as  $aeQ_eQ_1$  to society's benefit but only  $beQ_eQ_1$  to society's cost, yielding net social benefit/economic welfare of  $abe$ . From another perspective, restricting consumption/production to  $Q_1$  would mean forfeiting society's economic welfare/welfare loss of  $abe$ .

At output above  $Q_e$ , say at  $Q_2$ , the last unit consumed/produced adds more to society's cost ( $cQ_2$ ) than it does to society's benefit ( $dQ_2$ ). Society's welfare can be increased by lowering consumption/production from  $Q_2$  to  $Q_e$  as it would create as much as  $ecQ_2Q_e$  of cost savings for society while only forgoing  $edQ_2Q_e$  of social benefit, avoiding a potential welfare loss of  $cde$ .

At  $Q_e$ , marginal social cost = marginal social benefit =  $eQ_e$ . At this point, it is not possible to increase society's net benefit/economic welfare further by adjusting the level of output. This is the point of optimisation where society's economic welfare is maximised.

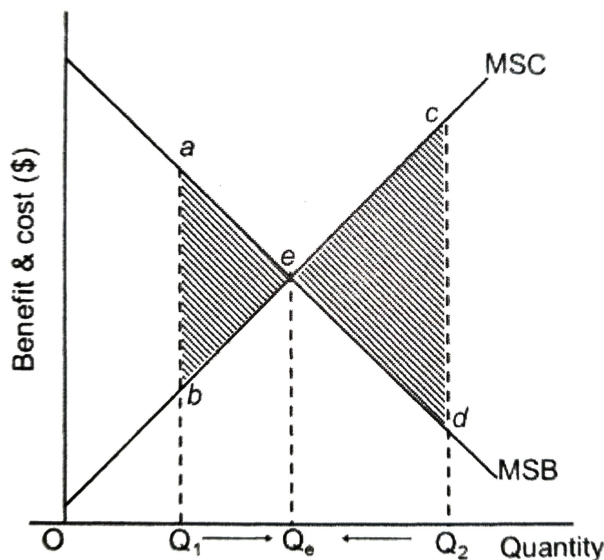


Figure 2.2.: Rational Decision-making by the Government

## 2.6. Intended and Unintended Consequences

The decisions, once made and acted upon, can give rise to both intended and unintended consequences. Take for example, the consideration of whether to raise tobacco taxes by the government:

- Intended benefits:
  - Achieve allocative efficiency (correcting the market failure) by tackling the over-consumption of tobacco arising from imperfect information and negative externality
  - Increase tax revenue for the government
- Unintended consequences:
  - Increase in smuggling of contraband cigarettes
  - Reduction in profits for cigarettes producers and retailers which could force them to lay-off their workers

Economic agents would have to anticipate and look out for the unintended consequences, in particular those which have a bearing on their own cost-benefit calculus. Having anticipated the unintended consequences, they are better able to put in place responses to:

- Take advantage of any positive impact and
- Manage the adverse impact

## 2.7. Perspectives

The decisions, once made and acted upon, will impact not only the economic agent making the decision, but also other economic agents. Whether the impact is positive or negative depends on the perspective. Economic decisions, once taken, will invariably create winners and losers. (Consider the consumer decision of purchasing a car and the government decision of raising tobacco taxes.)



## 2.8. Trade-offs

Decisions often involve trade-offs. The most straightforward trade-off arises from the **alternative uses of scarce resources and budget**. (e.g. a consumer, in deciding to spend on home development, has to cut back on foreign holidays; a government, in deciding to spend more on healthcare, has to cut back its support for the arts and culture).

Trade-offs can also be framed in terms of **competing goals**. (e.g. an individual, in choosing to enrol in training, could see a decline in current income in exchange for higher lifetime income and hence utility; a government, in raising tobacco taxes to correct market failure, could be achieving efficiency at the expense of equity (tobacco taxes are regressive)).

## 2.9. Dynamic Nature of Decision-making

Economic decisions are seldom one-off. At the **decision-making stage**, the economic agent is only able to make estimates of the benefit and cost of the decision – decisions are made based on **expected values** of benefits and costs.

Once the **decision is made**, the **actual** benefit and cost, including the **unintended** consequences, become apparent. External changes (e.g. changes in market conditions and the broader macroeconomy) that could also have occurred during this time would further change benefit and cost and generate unintended consequences.

The aims, constraints, costs, benefits, information and perspectives of economic agents can **change over time**. When changes occur, the economic decision undertaken by an agent may no longer be optimal, calling for a revisit of the decision-making process to ensure that the intended outcomes can be achieved.

The economic agent would then **review decisions** using the available data, revise their expected values of benefits and costs, and assess whether a course correction is necessary. At this point, the economic agent could realise that the initial decision has been regrettable or mistaken and change course, taking on a different decision or at least making adjustment to the original plan. The **cycle then repeats itself**.

## 2.10. Cognitive Biases

Behavioural economics reminds us that economic agents do not always behave rationally. They make "mistakes" in decision-making which may leave them worse-off and make them susceptible to manipulation.

### Examples of Cognitive Biases

#### Loss Aversion

Human beings experience losses asymmetrically more severely than equivalent gains. This being the case, humans tend to prefer avoiding a loss over making an equivalent or greater gain.

## *2. Decision-making Process of Economic Agents*

### **Sunk Cost Fallacy**

Thinking at the margin means to let the past go and to think forward to the **next unit** consumed/produced, the **next dollar** spent, the **next worker** hired, etc. It means to **ignore sunk costs**. Sunk costs are bygone and should not be taken into consideration when making purchasing decisions but often are.

Economic agents do now, however, always behave rationally. Sunk cost fallacy occurs when a person's decision is affected by sunk costs.

### **Salience Bias**

Generally, humans avoid stressful and demanding cognitive strain, often making them vulnerable to many biases. This "laziness" and desire for cognitive ease can lead individuals to a world of irrationality where they make decisions according to elements that appear the most salient.

## **Applications**

### **Design of Strategies/Policies**

In the later themes, we will see how governments are able to harness cognitive biases to enhance the effectiveness of their policies to correct market failure and achieve a more efficient allocation of resources. (e.g. Nutri-Grade on the front of beverage packaging and on menus) If individuals are aware of their cognitive biases which are causing them to make bad decisions, they can design mechanisms to overcome them.

**Part II.**

**Markets**

## 3. Price Mechanism and its Functions

The price mechanism allocates scarce resources in the free market by performing the following 3 functions.

### 3.1. Signalling Function

Prices perform a signalling function. This means that market prices will adjust to demonstrate where resources are required and where they are not.

### 3.2. Incentive Function

Market prices act as an incentive to raise output/production because the supplier stands to make a higher profit. As a result, resources move out of these other industries into a more profitable one. When demand falls *ceteris paribus*, the price of the good falls, disincentivising production.

### 3.3. Rationing Function

The price mechanism rations out the goods produced according to the willingness and ability to pay. Buyers who desire the good and can afford to pay the price obtain the item and those who cannot, go without.

The price mechanism, through the signalling, incentive and rationing functions, answer the fundamental questions of resource allocation in the **product market**:

- What to produce?
- For whom to produce?
- How much to produce?

To understand how the price mechanism answers the question of "how to produce", we need to look at the **factor market**:

The price mechanism **signals** the relative abundance of certain factors of production and **incentivises** firms to employ these factors of production that are more abundant and economise on the use of those factors of production that are less abundant, answering the question of "How to produce?". (e.g. labour-intensive method of production VS capital-intensive method of production)

## 4. Demand and Supply Analysis and its Applications

### 4.1. Demand

**Definition 4.1.** *Demand* is defined as the quantity of a good/service that a consumer is both willing and able to buy at each possible price during a given time period, *ceteris paribus*.

The *Marginalist Principle* can be used to explain the points on the demand curve. When thinking at the margin, consumers assess the costs and benefits of consuming one more unit of a good or service, where:

- **Marginal benefit (MB)** is the additional benefit from consuming an additional unit of the good/service.
- **Marginal cost (MC)** is the additional cost from consuming an additional unit of the good/service, which is its price.

Consumers will maximise their utility only when they consume a good/service up to where  $MB = MC$ . This is because:

- When  $MB > MC$ , consuming an additional unit of good benefits the consumer more than it costs the consumer. Hence, the rational decision is to consume the next unit.
- When  $MB < MC$ , consuming an additional unit of good costs the consumer more than it benefits the consumer. Hence, the rational decision is to not consume the next unit.

**Definition 4.2.** *Quantity demanded* is defined as the quantity of a good/service that a consumer is willing and able to buy at a given price over a given period of time.

Quantity demanded is hence a particular point on the demand curve.

### Market Demand

The market demand is the sum of the demands of all the consumers in the market.

## 4.2. Price Determinants of Demand

The **Law of Demand** states that in a given period of time, the quantity of a good demanded is inversely proportional to its price, *ceteris paribus*. This means that the higher the price of the good, *ceteris paribus*, the less the willingness and ability to buy the good and hence the smaller the quantity demanded. The converse is also true – at lower prices, a larger quantity is demanded.

The demand curve is generally downward sloping, reflecting the inverse relationship between the price of the good and the quantity demanded. Referring to Figure 4.1, as the price of the good declines from  $P_0$  to  $P_1$ , the quantity demanded rises from  $Q_0$  to  $Q_1$ . Graphically, this is represented as a movement from point A to point B along the same demand curve.

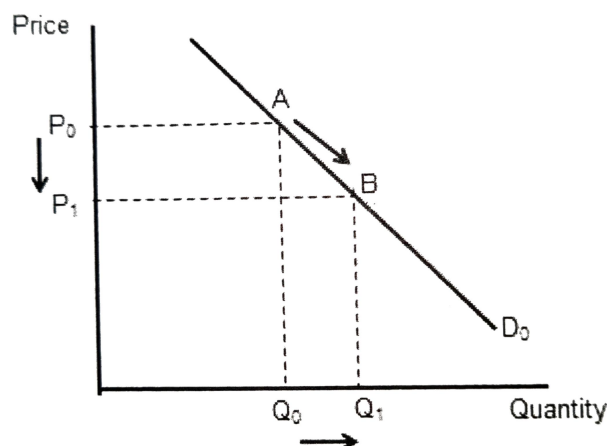


Figure 4.1.: Effect of a Price Change

## 4.3. Non-price Determinants of Demand

### Level and Distribution of Income

**Definition 4.3.** A *normal good* is a good whose demand rises as consumers' income rises, whereas an *inferior good* is a good whose demand falls as consumers' income rises.

As consumers' income rises, their ability to buy goods and services increases, and as rational utility maximisers, they will increase their demand for most goods. However, this is only true if we assume that the good is a normal good and not an inferior good.

Applying to the situation of a rise in income to the market for tea leaves and assuming tea leaves to be a normal good, an increase in income brings about an increase in the market demand. Referring to Figure 4.2, the increase in demand will lead to a rightward shift of the demand curve from  $D_0$  to  $D_1$ , indicating an increase in the quantity demanded at each and every price. At the same price of  $P_0$ , the quantity demanded of the good by consumers increases from  $Q_0$  to  $Q_1$ .

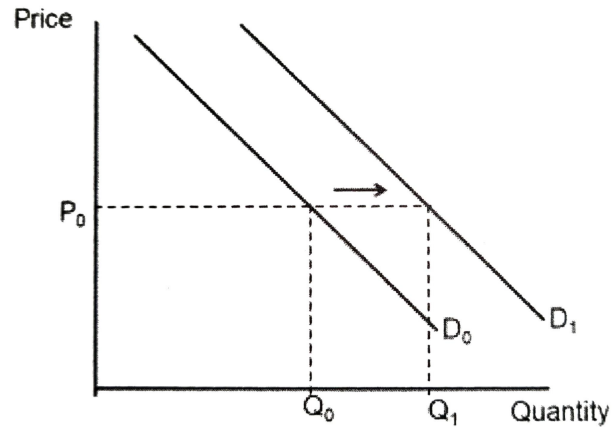


Figure 4.2.: Increase in Demand

## Price and Availability of Related Goods

### Substitutes

**Definition 4.4. Substitutes** are defined as a pair of goods considered by consumers to be alternatives to each other, with the level of utility/satisfaction derived from consuming either good being relatively similar.

A pair of goods considered to be substitutes will be tea and coffee. When the **price** of coffee falls, *ceteris paribus*, the quantity demanded for it will rise as rational consumers who aim to maximise their utility with their given income will switch away from tea and buy coffee instead. Demand for tea will thus decrease. For this reason, substitute goods are also called goods in **competitive demand**.

Figures 4.1 and 4.3 depict the relationship between substitutes. Referring to Figure 4.1, when the price of coffee falls from  $P_0$  to  $P_1$ , the quantity demanded increases from  $Q_0$  to  $Q_1$ , represented by a movement from point A to point B along the same demand curve  $D_0$ . Referring to Figure 4.3, holding the price of tea constant at  $P_2$ , the switch to coffee causes the quantity demanded of tea to fall from  $Q_2$  to  $Q_3$ , as represented by the leftward shift of the entire demand curve from  $D_2$  to  $D_3$ .

Besides changes in the prices of substitutes, changes in the **availability** of substitutes will also change the demand of a good, vice versa. For example, now that there are other types of tea like chamomile, mint and rose available in the market, the demand for traditional tea leaves will fall, *ceteris paribus*.

#### 4. Demand and Supply Analysis and its Applications

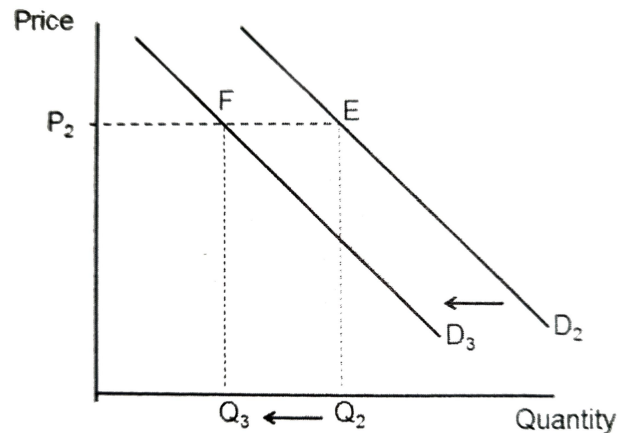


Figure 4.3.: Demand for Tea

### Complementary Goods

**Definition 4.5.** *Complementary goods* are defined as a pair of goods consumed together to satisfy the same want.

A pair of goods commonly consumed together is car and petrol. When the **price** of cars rises, *ceteris paribus*, the potential car buyers would reconsider their decision to buy a car and some among them would choose not to buy one. The quantity demanded for cars will fall, and consequently the demand for petrol will also fall. Complementary goods are hence also called goods in **joint demand**.

Besides the changes in price of complements, changes in the **availability** of complements will also change the demand for a good, *vice versa*. For example, with the development and introduction of the many portable devices that use Secure Digital (SD) memory card for data storage, the demand for SD memory cards is likely to increase, *ceteris paribus*.

### Derived Demand

The demand for one good occurs as a result of the demand for another. We do not want steel for itself. Rather, the demand for steel stems from the demand for the final product – cars. When the demand for cars rises, profit-motivated producers will want to step up the production of cars and thus increase the demand for inputs like steel. The demand for factor inputs is hence described as derived demand.

**Joint demand** – The 2 goods are bought by the **same** economic agent. (e.g. the buyer of motor vehicles is also the buyer of petrol)

**Derived demand** – The 2 goods are bought by 2 **different** economic agents. (e.g. household consumers demand for motor vehicles, creating the demand by car manufacturers for steel)



## Taste and Preference

The more desirable consumers find a good, *ceteris paribus*, the more of it they will consume at any given price to maximise their utility. Changing tastes are affected by a variety of influences including advertisements. For example, with a successful advertising campaign that emphasises the health benefits of tea, consumers might be influenced to perceive that tea is superior to other beverages and would hence increase demand for tea, *ceteris paribus*.

## Expectation of Future Prices

If consumers anticipate that the price of a good will rise significantly in the near future, *ceteris paribus*, the current demand for the good is likely to increase. This is because rational consumers, seeking to maximise their utility with their given budget, want to avoid paying a higher price to consume the same good in the future.

However, this is only possible if the good is non-perishable. For example, consumers cannot store up fruits and vegetables for long periods of time. Hence, they will not increase their demand for these perishables in the current period significantly even though they expect prices to increase in the near future.

## Government Policies

The government can influence demand through a number of policies introduced into the market. Such policies may take on forms such as:

- **Control-and-command** measures that improve/reduce access to specific types of goods directly. Examples of such measures include:
  - Raising/Lowering the income ceiling for families qualifying to purchase HDB flats
  - Raising/Lowering the legal age for alcohol/tobacco consumption
- Measures that improve/reduce access to specific types of goods through **altering the credit conditions**. Examples of such measures include:
  - Rules on loans to finance motor vehicles/properties
  - Rules on the use of credit cards

## Changes in the Demography of the Population

Changes in the demography of the population, such as the size and distribution will lead to changes in the demand for goods and services.

A rise in population will result to an increase in market demand for most goods and services, *ceteris paribus*.

The demand for specific types of goods and services will also change according to changes in the structure of the population. For example, with the proportion of elderly in the population increasing, there will be an increase in the demand for geriatric healthcare services and products.

## 4.4. Supply

**Definition 4.6.** *Supply* is defined as the quantity of a good/service that a producer is both willing and able to sell at each possible price during a given period of time, *ceteris paribus*.

Similar to the demand curve, the *Marginalist Principle* can also be used to explain the points on the supply curve. Producers will assess the costs and benefits of producing one more unit of a good or service, where:

- **Marginal benefit (MB)** is the additional benefit from supplying an additional unit of the good/service, which is its price.
- **Marginal cost (MC)** is the additional cost from supplying an additional unit of the good/service.

Producers will maximise their profits only when they supply a good/service up to where  $MB = MC$ . This is because:

- When  $MB > MC$ , supplying an additional unit of good benefits the producer more than it costs the producer. Hence, the rational decision is to produce the next unit.
- When  $MB < MC$ , supplying an additional unit of good costs the producer more than it benefits the producer. Hence, the rational decision is to not produce the next unit.

**Definition 4.7.** *Quantity supplied* is defined as the quantity of a good/service that a producer is both willing and able to sell at a given price during a given period of time, *ceteris paribus*.

## Market Supply

The market supply is the sum of the supply of all the producers in the market.

## 4.5. Price Determinants of Supply

The *Law of Supply* states that in a period of time, there is a direct relationship between the price and the quantity supplied, *ceteris paribus*. This means that the higher the price of the good, the greater the quantity that a producer is willing and able to supply to the market in a given period of time, *ceteris paribus*.

Graphically, this is depicted as an upward-sloping supply curve. Referring to [Figure 4.4](#), as the price of the good increases from  $P_0$  to  $P_1$ , the quantity supplied rises from  $Q_0$  to  $Q_1$ , represented as an upward movement from [point A](#) to [point B](#) along the same supply curve.

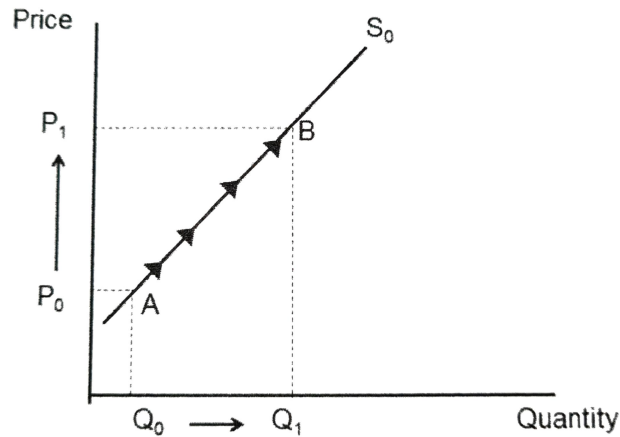


Figure 4.4.: Effect of a Price Change

## 4.6. Non-price Determinants of Supply

### Marginal Cost of Production

When the marginal cost (MC) or cost of producing an additional unit of output rises, firms reduce supply. Conversely, when MC falls, firms increase supply. The increase in supply can be explained by the rightward shift of the supply curve.

Holding the selling price of the good constant, a reduction in marginal cost leaves firms with positive marginal profits, incentivising firms to increase production to capture the additional profits. Referring to Figure 4.5, at the same price of  $P_0$ , the quantity supplied rises from  $Q_0$  to  $Q_1$ , represented by a rightward shift of the supply curve from  $S_0$  to  $S_1$ .

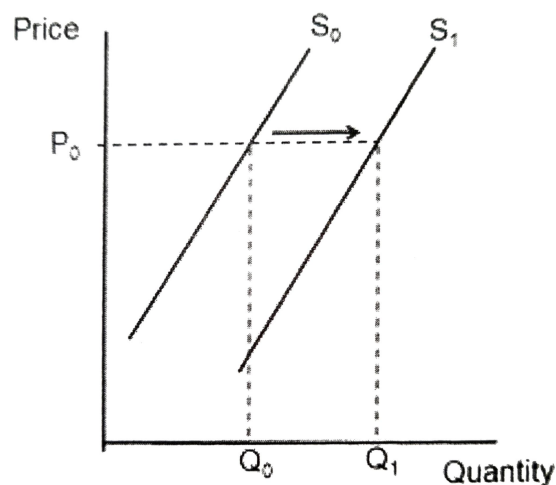


Figure 4.5.: Increase in Supply

### Factors Affecting Marginal Cost

- **Price of Factor Inputs**

- A change in the price of variable inputs such as wages and raw material prices will cause a change in the cost of producing an additional unit of good.
- For example, if the price of fertiliser falls, *ceteris paribus*, the marginal cost of producing an additional unit of tea leaves falls relative to the marginal revenue, incentivising profit-maximising firms to increase supply to capture the marginal profit.

- **Technology**

- Improvement in scientific knowledge and organisational changes such as automation, better management practices and mergers can also bring about productivity increase, reducing the input required for each additional unit of output. This lowers the marginal cost of production relative to the marginal revenue, incentivising profit-maximising firms to increase supply to capture the marginal profit.

### Government Policies

#### Indirect Tax

**Definition 4.8.** *Indirect tax* is a levy imposed by the government on the production of goods and services.

Indirect tax can be broad-based such as the Goods and Services Taxes (GST) in Singapore or on specific types of goods such as the 'sin tax' on alcohol and tobacco. The immediate effect of an indirect tax would be to increase the marginal cost of production (and therefore reduce the supply). For rational and profit-maximising producers, they will now be willing and able to supply the same units of output only at higher prices. This is shown by a shift of the entire supply curve upwards.

Indirect tax can take the form of:

- **Specific Tax**

**Definition 4.9.** *Specific tax* is tax levied at a fixed rate per unit of output.

(e.g. tax of \$1 for every unit of output) This will lead to a parallel upward shift of the supply curve with the vertical distance between the 2 supply curves being the amount of tax per unit of output.

- **Ad-valorem Tax**

**Definition 4.10.** *Ad-valorem tax* is tax levied at a percentage of the price per unit of output.

(e.g. 9% GST) This means that the absolute amount of tax (in dollars and cents) is lower at lower price level than it is at higher price level. Graphically, this is represented by a pivotal shift of the supply curve.

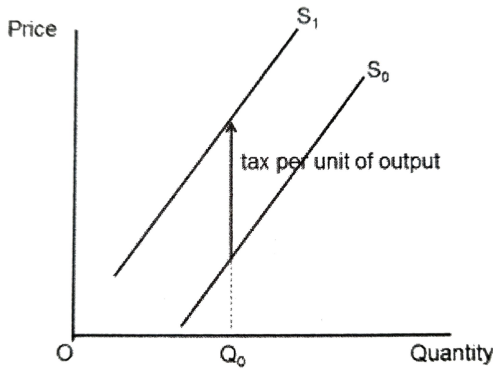


Figure 4.6.: Specific Tax

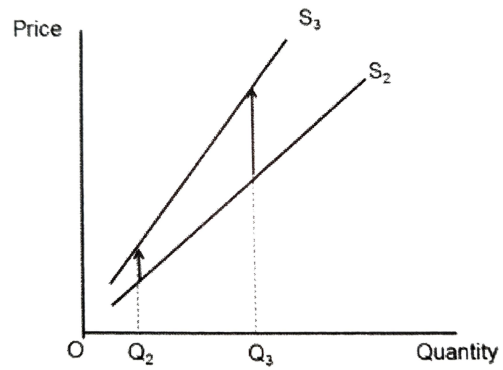


Figure 4.7.: Ad-valorem Tax

## Subsidy

**Definition 4.11.** *Subsidy* is the provision of money and other resources by the government to support a person or business activity.

Indirect subsidies such as wage subsidy help to reduce the marginal cost of production, which in turn shifts the supply curve downwards.

Indirect subsidies can take the form of:

- Specific Subsidy

**Definition 4.12.** *Specific subsidy* is given at a fixed rate per unit of output.

This will bring about a parallel downward shift of the supply curve, with the vertical distance between the 2 supply curves being the amount of subsidy per unit of output.

- Ad-valorem Subsidy

**Definition 4.13.** *Ad-valorem subsidy* is given as a percentage of the price of the good.

This will bring about a pivotal shift of the supply curve.

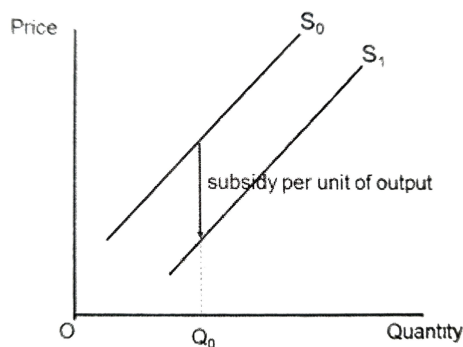


Figure 4.8.: Specific Subsidy

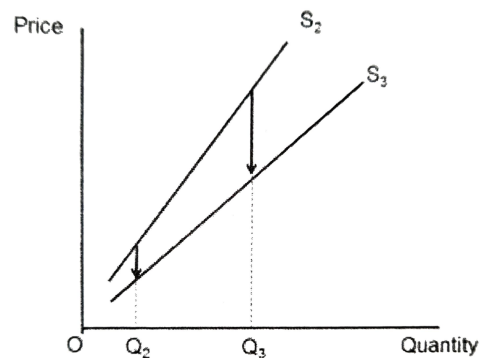


Figure 4.9.: Ad-valorem Subsidy

#### 4. Demand and Supply Analysis and its Applications

Apart from taxes and subsidies, governments also rely on directives and legislation, extend financing schemes to firms, provide technical support, etc., measures which would also have an effect on the market supply.

### Prices of Related Goods

#### Goods in Joint Supply

Where the production of more of one good leads to the production of more of the other. Take cow hide and beef steak as an example. When profit-maximising firms, in response to higher leather prices, slaughter more cows, they will simultaneously increase the supply of beef steaks into the market.

Referencing [Figure 4.4](#), in the market for cow hides, the change is represented as an upward movement along the same supply curve  $S_0$  as quantity supplied increases from  $Q_0$  to  $Q_1$ , in response to the increase in the price of cow hides from  $P_0$  to  $P_1$ . Referring to [Figure 4.5](#), in the market for beef steak, the change is represented as a rightward shift of the entire supply curve from  $S_0$  to  $S_1$ . Without the price of steak changing, the act of slaughtering more cows to produce more hides will increase the quantity supplied for beef steak from  $Q_0$  to  $Q_1$  at price  $P_0$ .

#### Goods in Competitive Supply

Where the increased production of one good means diverting resources away from producing the other. A pair of goods which share a competitive supply relationship is corn as food and ethanol. In the US, corn which could have been used for food is diverted to the production of ethanol through the implementation of laws and provision of ethanol subsidies by the federal government. The increase in supply of ethanol is hence at the expense of the supply of corn for food.

### Expectations of Future Prices

If the price of a good is expected to rise, producers may temporarily hold back the amount of goods they release into the market. Rational producers are likely to build up their stocks so as to sell at a higher price in the future. Hence, the current supply of the good falls as the willingness to supply at the current time period falls.

### Sellers in the Market

The number of sellers in the market can affect the supply of goods and services. For instance, the potential for supernormal profits, combined with the lowering of barriers to entry into an industry, attract more firms to enter the market. As a result, at every price level, with more producers willing and able to enter the market, the market supply increases, shown by a rightward shift of the supply curve.

### Nature, Random Shocks and Other Unpredicted Events

Adverse weather (e.g. droughts and floods) can greatly reduce agricultural output. Wars and natural disasters (e.g. earthquakes and tsunamis) can kill many people, including workers, destroy capital (buildings and machineries) and reduce production capacity. Events (e.g. industrial dispute and political unrest) will disrupt production.

These will reduce the ability of producers to supply goods and services in the market and the supply curve hence shifts leftwards.

## 4.7. Market Equilibrium

In perfectly competitive markets, prices will adjust until the point where **quantity demanded by buyers exactly equals quantity supplied by producers**. At this point, there is no further pressure on price and quantity to adjust. The market is said to have reached a point of equilibrium.

Shortages and surpluses are denoted by horizontal distances (not areas) in demand-supply diagrams.

## 4.8. Market Disequilibrium

Annotate the shortage/surplus on the diagram.

### Effect of Demand Change

An **increase in demand** may arise from a change in any of its non-price determinants. Graphically, this is represented by a rightward shift of the entire demand curve from  $D_0$  to  $D_1$  (Figure 4.10). The increase in demand, holding supply constant, creates a shortage of  $Q_0Q_2$  at the original equilibrium price  $P_0$ . Buyers, competing for the good, bid up prices.

As the price rises, quantity demanded decreases while quantity supplied increases. This process continues until the price eventually reaches  $P_1$  where quantity demanded exactly balances quantity supplied and the shortage is eliminated, removing further pressure on the market to adjust. The equilibrium quantity rises from the original  $Q_0$  to a higher  $Q_1$ .

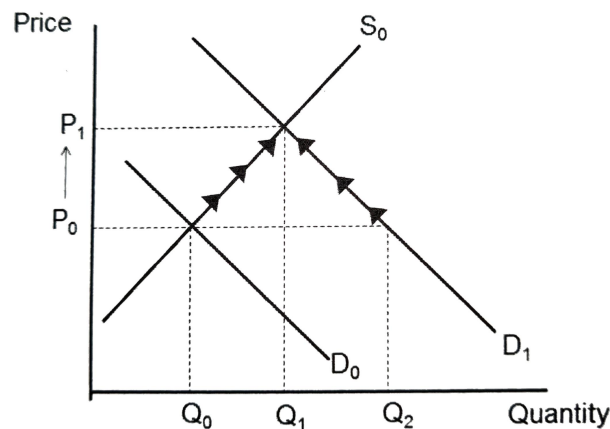


Figure 4.10.: Effect of Demand Change

## Effect of Supply Change

An increase in supply may arise from a change in any of its non-price determinants. Graphically, this is represented by a rightward shift of the supply curve from  $S_0$  to  $S_1$  (Figure 4.11). The increase in supply, holding demand constant, creates a surplus of  $Q_0Q_2$  at the original price  $P_0$ . To remove the surplus, firms cut prices.

As the price falls, quantity demanded increases while quantity supplied declines. This process continues until the price eventually reaches  $P_1$  where the quantity demanded exactly balances the quantity supplied and the surplus is eliminated, removing further pressure on the market to adjust. The equilibrium quantity rises from the original  $Q_0$  to a higher  $Q_1$ .

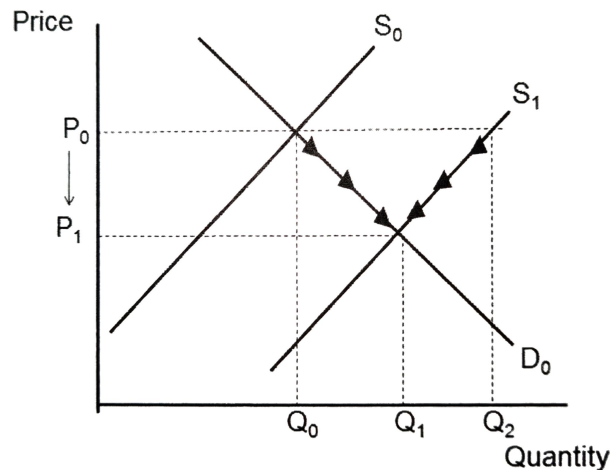


Figure 4.11.: Effect of Supply Change

## Effect of Simultaneous Demand and Supply Changes

### Increase in Both Demand and Supply

With consumers entering the market to demand for more units of the good and simultaneously producers entering the market to supply more units of the good, the equilibrium quantity must necessarily increase.

The effect on the **equilibrium price** is, on the other hand, indeterminate. It depends on the relative magnitude of the increase in demand and supply:

- **Case 1:** When demand increases by a larger magnitude than does supply, a shortage is created at the original equilibrium price level. Buyers, competing for the good, bid up prices.
- **Case 2:** When the supply increases by a larger magnitude than does demand, a surplus is created at the original equilibrium price level. To remove the surplus, firms cut prices.
- **Case 3:** When demand and supply both increase by the same extent, quantity demanded exactly equals quantity supplied, leaving neither shortage nor surplus. There is therefore no pressure on prices to adjust.

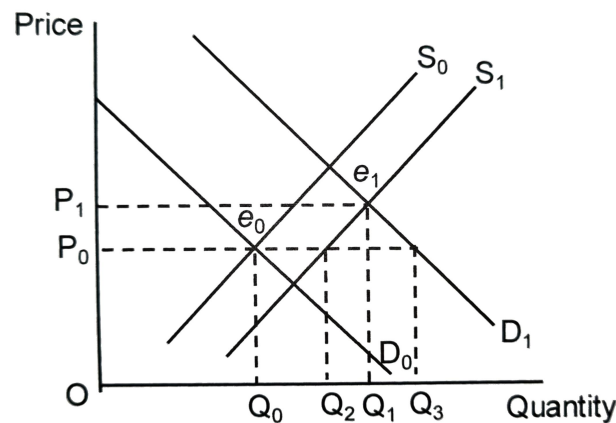


**Expounding on Case 1:**

Referring to Figure 4.12, when demand increases by a larger magnitude ( $D_0$  to  $D_1$ ) than does supply ( $S_0$  to  $S_1$ ), a shortage of  $Q_2Q_3$  is created at the original equilibrium price level  $P_0$ . Buyers, competing for the good, bid up prices.

As the price rises, quantity demanded decreases while quantity supplied increases. This process continues until the price eventually reaches  $P_1$  where the quantity demanded exactly balances the quantity supplied and the shortage is eliminated, removing further pressure on the market to adjust.

With the increase in both demand and supply, the new equilibrium quantity increases from the original  $Q_0$  to a higher  $Q_1$ .



**Figure 4.12.:** Magnitude of Increase in Demand > Magnitude of Increase in Supply

**Increase in Demand and Decrease in Supply**

An increase in demand with a simultaneous decrease in supply will give rise to a shortage at the original market price. In such an instance, the market price must necessarily increase as buyers, competing for the good, bid up prices.

The effect on **equilibrium quantity**, on the other hand, is indeterminate. It depends on the relative magnitude of the demand and supply changes:

- **Case 1:** Where the magnitude of the increase in demand exceeds the magnitude of the decrease in supply, there would be an overall increase in the number of units of the good exchanged – the equilibrium quantity increases.
- **Case 2:** Where the magnitude of the decrease in supply exceeds the magnitude of the increase in demand, there would be an overall decrease in the number of units of the good exchanged – the equilibrium quantity decreases.
- **Case 3:** Where the magnitude of the increase in demand exactly equals the magnitude of the decrease in supply, the number of units of the good exchanged will remain unchanged – the equilibrium quantity remains constant.

#### 4. Demand and Supply Analysis and its Applications

##### Expounding on Case 1:

Referring to Figure 4.13, with a simultaneous increase in demand ( $D_0$  to  $D_1$ ) and decrease in supply ( $S_0$  to  $S_1$ ), a shortage of  $Q_2Q_3$  is created at the original equilibrium price level  $P_0$ . Buyers, competing for the good, bid up prices.

As the price increases, quantity demanded decreases while the quantity supplied increases. This process continues until the price eventually reaches  $P_1$  where quantity demanded exactly balances quantity supplied and the shortage is eliminated, removing further pressure on the market to adjust.

Given that the magnitude of the increase in demand is more than the magnitude of the decrease in supply, the new equilibrium quantity rises from the original  $Q_0$  to a higher  $Q_1$ .

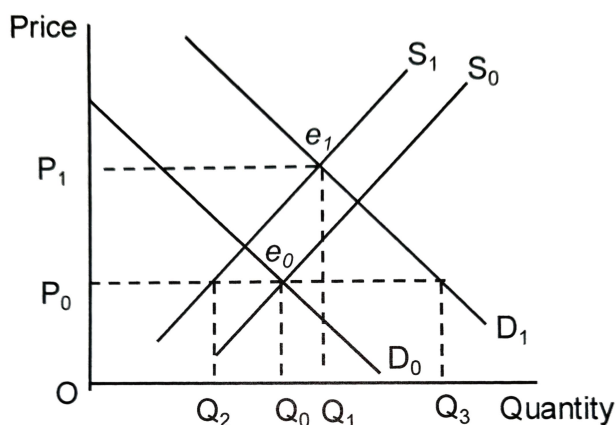


Figure 4.13.: Magnitude of Increase in Demand > Magnitude of Decrease in Supply

### 4.9. Price Elasticity of Demand

**Definition 4.14.** *Price elasticity of demand (PED)* is a measure of the degree of responsiveness of the quantity demanded for a good to a change in the price of the good itself, ceteris paribus.

$$PED = \frac{\% \text{ change in quantity demanded for a good}}{\% \text{ change in price of the good itself}}$$

The sign of PED is **negative** because the **Law of Demand** states that quantity demanded is inversely proportional to the price. An increase in the price of the good will lead to a decrease in quantity demanded, ceteris paribus.

Accepting that the sign of PED is negative most of the time, we often drop the negative sign and look at the absolute value when studying PED, simply for convenience.

## Magnitude of PED

### Price Elastic Demand

**Definition 4.15.** Demand is said to be *price elastic* when a given change in the price of a good results in a more than proportionate change in quantity demanded in the opposite direction, ceteris paribus.

$$|PED| > 1$$

### Price Inelastic Demand

**Definition 4.16.** Demand is said to be *price inelastic* when a given change in the price of a good results in a less than proportionate change in quantity demanded in the opposite direction, ceteris paribus.

$$|PED| < 1$$

Referring to Figure 4.14, for the same price decrease from  $P_1$  to  $P_2$ , the given price reduction results in a larger magnitude of increase in the quantity demanded ( $Q_1$  to  $Q_3$ ) along the more price elastic demand curve,  $D_1$ , than that in the quantity demanded ( $Q_1$  to  $Q_2$ ) when demand is less price elastic (along  $D_2$ ), ceteris paribus.

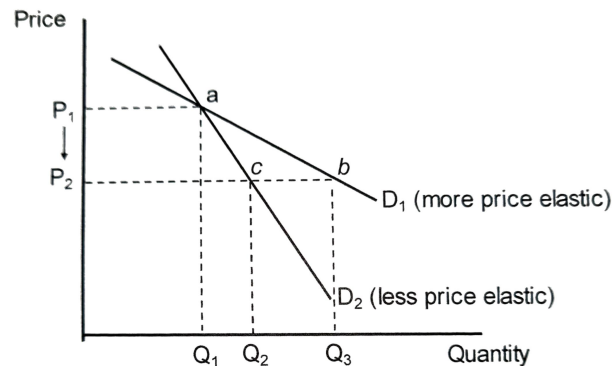


Figure 4.14.: Demand Curves with Different PED at the Same Pivotal Point

### Unitary Price Elastic Demand

**Definition 4.17.** Demand is *unitary price elastic* when a change in price of the good results in a proportionate change in the quantity demanded of the good in the opposite direction, ceteris paribus.

$$|PED| = 1$$

#### 4. Demand and Supply Analysis and its Applications

##### Perfectly Price Inelastic Demand

**Definition 4.18.** Demand is *perfectly price inelastic* when a given change in price of the good itself produces no change in the quantity demanded of the good, ceteris paribus.

There is total unresponsiveness of quantity demanded to price changes and the demand curve is a vertical line.

$$PED = 0$$

##### Perfectly Price Elastic Demand

**Definition 4.19.** Demand is *perfectly price elastic* when a given change in price of the good itself leads to an infinitely large change in quantity demanded, ceteris paribus.

There is perfect/infinite responsiveness of quantity demanded to a change in price and the demand curve is a horizontal line.

$$|PED| \rightarrow \infty$$

#### Determinants of PED

##### Availability and Closeness of Substitutes

The greater the availability of substitutes and the closer these substitutes are for a particular good/service, the more price elastic will be its demand, ceteris paribus.

A good/service with many close substitutes, compared to another with fewer close substitutes, will experience a larger proportionate fall in quantity demanded with a rise in its price, as consumers readily switch to other products to satisfy the same want.

Consider the example of apples (many substitutes) and flour (few substitutes).

##### Proportion of Income Spent on the Good

The greater the proportion of a person's income that is spent on a good, the more price elastic will be its demand, ceteris paribus.

Consider the example of overseas holidays (larger proportion of income) and salt (minute proportion of income).

##### Degree of Necessity

Necessities are goods/services that we consider to be essential in our lives and have to be consumed despite price changes. Hence, demand for necessities is relatively price inelastic compared to that for non-necessities.

Consider the example of rice (a staple food in Asian culture) and jewellery (non-necessity).

### Addiction

The greater the degree of addiction to a substance such as drugs, cigarettes, etc., the more price inelastic the demand, *ceteris paribus*.

Consumers who are severely addicted to a good/service would be highly dependent on it and will be willing to pay a higher price to continue to consume the substance.

For example, a given % increase in the price of both cigarettes and nachos may be expected to produce a smaller % decrease in the quantity demanded for cigarettes than nachos, the latter being an item that is not additive in nature.

### Time Period

The longer the time period in which a consumer makes a purchasing decision, the more price elastic the demand, *ceteris paribus*.

As time goes by, consumers have the opportunity to get information on the availability of substitutes, compare prices and adapt their tastes and preferences.

Consider the example of the increase in the price of flour (short run: may not be able to switch to alternative forms of staple food immediately; long run: more able to adapt to other alternatives and acquire a taste for rice and other types of grains). A given % increase in the price of flour may be expected to produce a larger % decrease in quantity demanded in the long run than the short run, *ceteris paribus*.

## 4.10. Price Elasticity of Supply

**Definition 4.20.** *Price elasticity of supply (PES)* is a measure of the responsiveness of the quantity supplied of a good to changes in its price, *ceteris paribus*.

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

The sign of the PES is **positive** because the **Law of Supply** states that quantity supplied of a good is positively related to its price, *ceteris paribus*.

### Magnitude of PES

#### Price Elastic Supply

**Definition 4.21.** Supply is said to be **price elastic** when a given change in the price of a good results in a more than proportionate change in the quantity supplied in the same direction, *ceteris paribus*.

$$PES > 1$$

#### 4. Demand and Supply Analysis and its Applications

##### Price Inelastic Supply

**Definition 4.22.** Supply is said to be *price inelastic* when a given change in the price of a good results in a less than proportionate change in the quantity supplied in the same direction, ceteris paribus.

$$0 < PES < 1$$

Referring to Figure 4.15, the same price increase from  $P_0$  to  $P_1$  results in a larger magnitude of increase in the quantity supplied ( $Q_0$  to  $Q_2$ ) along the more price elastic supply curve,  $S_2$ , than that in the quantity supplied ( $Q_0$  to  $Q_1$ ) when supply is less price elastic ( $S_1$ ), ceteris paribus.

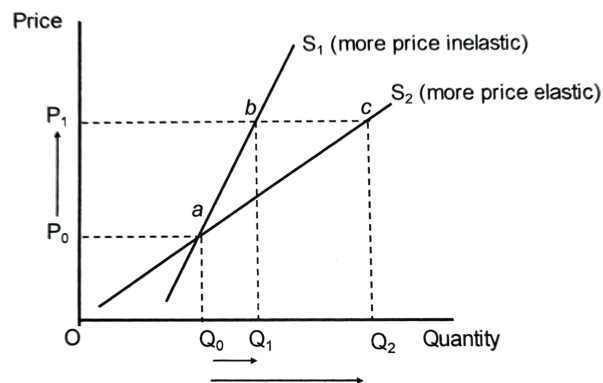


Figure 4.15.: Supply Curves with Differing PES at the Same Pivotal Point

##### Unitary Price Elastic Supply

**Definition 4.23.** Supply is said to be *unitary price elastic* when a given change in the price of a good results in a proportionate change in quantity supplied in the same direction, ceteris paribus.

$$PES = 1$$

##### Perfectly Price Inelastic Supply

**Definition 4.24.** Supply is *perfectly price inelastic* when a given change in the price of the good itself produces no change in the quantity supplied, ceteris paribus.

There is total unresponsiveness of quantity supplied to price changes and the supply curve is a vertical line.

$$PES = 0$$

## Perfectly Price Elastic Supply

**Definition 4.25.** Supply is *perfectly price elastic* when a given change in the price of the good leads to an infinitely large change in quantity supplied, *ceteris paribus*.

There is perfect/infinite responsiveness of quantity supplied to a change in price and the supply curve is a horizontal line.

$$PES \rightarrow \infty$$

## Determinants of PES

### Availability of Stock

Firms with larger availability of stock are more able to respond to price changes. Hence, supply of goods with longer shelf life (e.g. canned food) is more price elastic than the supply of perishable goods (e.g. fresh vegetables). This is because perishable goods cannot be stored for long periods of time. Given an increase in the price of vegetables, producers cannot increase the quantity of vegetables supplied into the market easily as they are unable to draw from their stocks/inventories.

The larger the availability of stocks, the larger the increase in quantity supplied that firms will be able to bring into the market when its price increases, accounting for the larger PES value.

### Existence of Spare Capacity

Firms have the ability to increase production when existing capacity is not fully utilised. On the other hand, should firms be already operating close to full capacity, it will be difficult for them to increase quantity supplied in response to a price raise.

The greater the spare capacity, the higher is the PES and the more price elastic the supply.

### Mobility of Factors of Production

**Definition 4.26.** *Mobility of factors of production* measures the degree to which a factor of production is willing and able to switch between different locations or uses.

- **Geographical Mobility:**

- The ease with which factors of production can move between different physical locations.
- Consider the example of the geographical mobility of construction workers (to other provinces/places to increase the quantity of new housing supplied) – offer wages and accommodation to facilitate these workers' relocation → higher PES for new housing

- **Occupational Mobility:**

- Is the ease with which factors of production can move between different industries. For industries that use factor inputs that can easily switch from one use to another, the supply of their goods will be more price elastic.
- Consider the examples of textile production and medical service provision. (textile production: does not require workers to be highly skilled; medical industry: requires highly-specialised set of skills)

## 4. Demand and Supply Analysis and its Applications

### Time Period

The ability of firms to respond to price changes by altering their quantity supplied varies over time. The longer the time allowed for adjustment, the more resources can flow into/out of an industry through expansion/contraction of existing firms.

For example, in the short run, even when rising oil prices provide the incentive for petroleum refiners to increase quantity supplied, their ability to expand output will be limited by fixed factors such as the refining plant and equipment they have at their disposal. Over time, however, some refining companies might be able to recondition old equipment that had fallen into disuse. They can also place orders for new petroleum-refining equipment and acquire the physical land they need to set up a larger plant that can handle more crude oil. The same given price increase will bring about a larger increase in quantity supplied in the long run than in the short run. Hence, supply is relatively more inelastic in the short run than in the long run.

### 4.11. Applications of Elasticity Concepts

The direction and magnitude of the change in market price and quantity exchanged will determine the **effect on**:

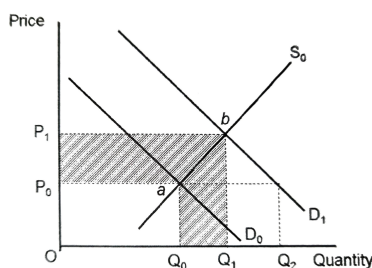
- consumer expenditure and producer revenue
- government tax revenue and subsidy outlay
- the effectiveness and success of government policies
- consumer and producer surpluses

### Effect of Demand Change

An increase in demand, *ceteris paribus*, leads to increases in both market price and quantity. With both market price and quantity increasing, consumer expenditure must increase. Assuming the absence of taxes and subsidies, what is spent by consumers is what is received by firms.

$$\text{consumer expenditure} = \text{producer revenue} = \text{price per unit} \times \text{no. of units sold/purchased}$$

Referring to **Figure 4.16** the original equilibrium point **a** where the market demand  $D_0$  intersects supply  $S_0$ , market price =  $P_0$ , quantity exchanged =  $Q_0$  and consumer expenditure = producer revenue = area  $OP_0aQ_0$ . An increase in demand to  $D_1$ , holding supply constant at  $S_0$ , yields a new equilibrium at point **b**, where market price =  $P_1$ , quantity exchanged =  $Q_1$  and consumer expenditure = producer revenue = area  $OP_1bQ_1$ .



**Figure 4.16.:** Effect of Increase in Demand



## Price Elasticity of Demand and How it Affects Consumer Expenditure

A decrease in supply, *ceteris paribus*, leads to an increase in market price and a decrease in quantity exchanged. When the market price and quantity change in opposite directions, the overall effect on consumer expenditure depends on the price elasticity of demand.

### Price Elastic Demand

When the demand of a good is price elastic, a change in price leads to a more than proportionate change in its quantity demanded in the opposite direction, *ceteris paribus*. From Figure 4.17, an increase in price from  $P_0$  to  $P_1$  leads to a more than proportionate fall in quantity demanded from  $Q_0$  to  $Q_1$ . Hence, there is a net decrease in consumer expenditure from  $OP_0bQ_0$  to  $OP_1cQ_1$ .

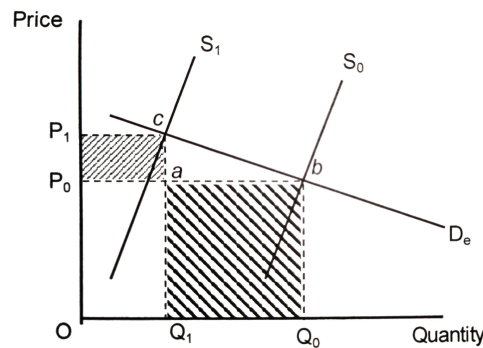


Figure 4.17.: Effect of a Price Increase on Consumer Expenditure

### Price Inelastic Demand

When the demand of a good is price inelastic, a change in price leads to a less than proportionate change in its quantity demanded in the opposite direction, *ceteris paribus*. From Figure 4.18, an increase in price from  $P_0$  to  $P_1$  as a result of the decrease in supply from  $S_0$  to  $S_1$  leads to a less than proportionate decrease in quantity demanded from  $Q_0$  to  $Q_1$ . Hence, there is a net increase in consumer expenditure from  $OP_0aQ_0$  to  $OP_1bQ_1$ .

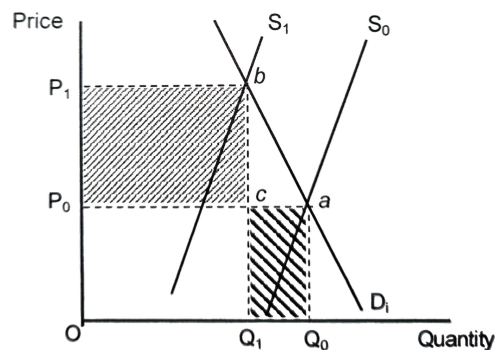


Figure 4.18.: Effect of a Price Increase on Consumer Expenditure

### Unitary Price Elastic Demand

When demand is unitary price elastic, a change in price leads to a proportionate change in its quantity demanded in the opposite direction, *ceteris paribus*. Consumer expenditure is unchanged.

## 4.12. Limitations in the Use of Elasticity Concepts

### Accuracy and Reliability of Data

Data collection of elasticity values of goods and services requires governments/firms to incur time and effort, which may be a costly process. Furthermore, data reflecting accurate consumers' preferences and responses may be difficult to obtain. Hence, most governments/firms in the real world can only make rough estimates of various elasticity values, where relevance and usefulness will be compromised.

### Ceteris Paribus Condition

Recall that the measurement of elasticity values allows for only one demand/supply determinant to change at a time, holding all other factors constant. In the real world, market conditions are constantly changing and are almost impossible to be held constant. This uncertainty in demand and supply forces makes measurement of elasticity values in the real world difficult. Additionally, given the frequent and often unanticipated changes in market conditions, by the time the data has been collected and calculations made, the data would have already been outdated.

### Revenue VS Profit

Using demand elasticity concepts, firms can make output and pricing decisions to increase the total revenue that they can receive. However, the objective of most firms is to maximise their profits, which is the difference between their revenue and cost. Demand elasticity concepts only allow firms to understand their revenue. Without information on the possible cost changes, the impact on profit cannot be determined.

## 5. Government Intervention in Markets

### 5.1. Taxes

**Definition 5.1.** *Taxes* are involuntary payment of funds to the government by a household/firm for which the household/firm receives no goods and services in return.

Taxes may be direct or indirect (refer to page 28 for more elaboration on indirect tax).

**Definition 5.2.** *Direct tax* is a compulsory levy imposed by the government in the income and wealth received by households and firms.

Examples of direct tax: personal income tax and wealth tax. The immediate effect of direct tax on households would be to reduce disposable incomes and hence the purchasing power of consumers.

### 5.2. Effects of Indirect Tax

#### On Equilibrium Price and Quantity

An indirect tax of \$t per unit of output raises firms' marginal cost. Firms, as rational profit maximisers, respond by reducing supply to avoid the marginal loss. A reduction in the market supply from  $S_0$  to  $S_1$  creates a shortage of  $je_0$  at the original equilibrium price  $P_0$ , which results in the rise of the equilibrium price from  $P_0$  to  $P_1$  and the fall in equilibrium quantity from  $Q_0$  to  $Q_1$ .

#### On Government Tax Revenue

$$\text{government tax revenue} = \text{tax per unit of output} \times \text{units of output} = \text{area } P_1e_1iP_2$$

#### On Consumer Expenditure and Producer Revenue

##### Consumer Expenditure

The indirect tax raises the price consumers pay from  $P_0$  to  $P_1$ , causing budget-constrained utility-maximising consumers to cut back quantity demanded from  $Q_0$  to  $Q_1$ .

As the price consumers pay per unit of output and the quantity exchanged changes in opposite directions, the final effect on consumer expenditure depends on the PED.

### Producer Revenue

While producers receive from consumers price  $P_1$  per unit, they must also surrender to the government in tax  $t$  per unit of output. The final price per unit received by the producers after payment of the tax is only  $P_2$ . Producer revenue decreases from area  $OP_0e_0Q_0$  to area  $OP_2iQ_t$ .

As the price producers receive per unit of output and the number of units sold decreases, with the tax, producer revenue decreases regardless of PED.

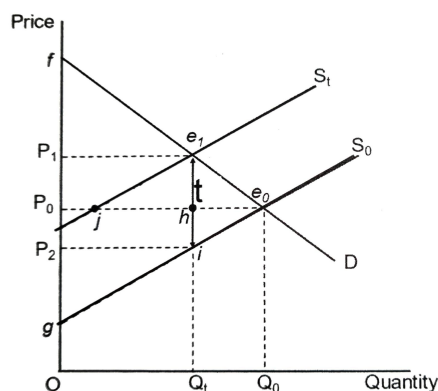


Figure 5.1.: Effect of an Indirect Tax (Specific Tax)

## On Government's Microeconomic Goals of Efficiency and Equity

### Allocative Efficiency

If the market is efficient to begin with, i.e. when the current level of output is one that maximises society's welfare, government interventions that cause deviations from this market outcome must necessarily lead to a loss of economic welfare. Hence, indirect taxes distort price signals and lead to a loss of allocative efficiency.

### Equity

Indirect taxes tend to be regressive in nature, leading to greater inequality. Such taxes on expenditure applies equally to every purchaser but results in taking a larger percentage of income from a low-income person than a high-income person.

An exception would be indirect taxes on goods and services that are mainly bought by households with high income or wealth. For example, indirect taxes on luxury cars and luxury private properties in Singapore.

### Implementation Problems

Black markets may be created when governments levy high indirect taxes on some products such as cigarettes. Smokers will try to find a way to satisfy their addiction in the face of high taxes. Smugglers have an incentive to import cigarettes from countries where there is no/lower tax, undercut the legal sellers and gain profits. The existence of black markets also undermines the effectiveness of the tax as a policy to discourage smoking. To ensure effectiveness of the policy, the government will have to step up efforts to conduct checks and enforce the rules, efforts which take scarce resources away from alternative uses.

Taxes are politically unpopular and are often met with fierce resistance.

### 5.3. Application of the PED to Study the Effects of Indirect Tax

#### Effect on Consumer Expenditure

In addition to the explanation for the effect on consumer expenditure in Section 5.2.

Where demand is **price elastic**, the increase in price brings about a more than proportionate decrease in quantity demanded from  $Q_0$  to  $Q_e$ . With the tax, the increase in consumer expenditure from the higher price paid per unit, area  $P_0P_e cf$ , is less than the decrease in consumer expenditure from the reduction in the number of units consumed, area  $Q_e feQ_0$ . Hence, consumer expenditure decreases from area  $OP_0eQ_0$  to area  $OP_e cQ_e$ .

Where demand is **price inelastic**, the increase in price brings about a less than proportionate decrease in quantity demanded from  $Q_0$  to  $Q_i$ . The increase in consumer expenditure from the higher price per unit, area  $P_0P_i ag$ , is greater than the decrease in consumer expenditure from the reduction in the number of units consumed, area  $Q_i geQ_0$ . Hence, consumer expenditure increases from area  $OP_0eQ_0$  to area  $OP_i aQ_i$ .

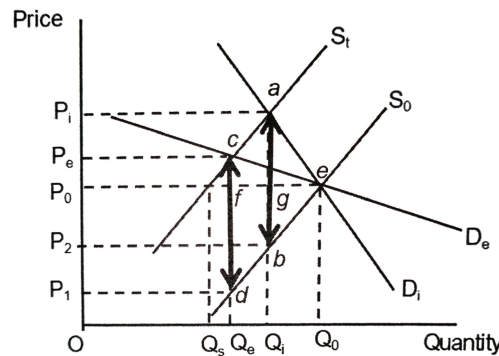


Figure 5.2.: Effect of Indirect Tax on Market Outcome

#### Effectiveness of Indirect Tax in Discouraging Competition

If the objective of the indirect tax is to discourage consumption, the policy will be more effective with a more price elastic demand. The more price elastic the demand, the more responsive quantity demanded is to price changes and the smaller the price increase needed to induce a large enough reduction in quantity demanded to eliminate the shortage to establish a new equilibrium.

The imposition of the indirect tax which reduces supply and shifts the supply curve from  $S_0$  to  $S_t$  results in a greater reduction in quantity exchanged ( $Q_0Q_e$  compared to  $Q_0Q_i$ ) along the more price elastic demand curve  $D_e$  than along the relatively price inelastic demand curve  $D_i$ . Faced with the same supply curve  $S_t$ , the smaller resultant increase in price results in an increase in quantity supplied.

Goods which governments deem as undesirable such as cigarettes are addictive and have price inelastic demand. To achieve the intended reduction in quantity demanded through indirect taxes would therefore require a high tax rate given the unresponsiveness of quantity demanded to price.

## Effectiveness of Indirect Tax in Raising Government Tax Revenue

If the objective of the indirect tax is to raise tax revenue, the policy will be more effective with a more price inelastic demand. As quantity demanded is less responsive to price changes, the more price inelastic the demand, the more tax revenue the government can generate.

The imposition of the indirect tax produces a smaller reduction in quantity exchanged ( $Q_0Q_i$  compared to  $Q_0Q_e$ ) along the price inelastic demand curve  $D_i$  than the price elastic demand curve  $D_e$ , allowing the government to generate higher tax revenue in the former than the latter, area  $P_2P_iab$  compared to area  $P_1P_e cd$ .

## 5.4. Subsidies

**Definition 5.3.** *Indirect subsidy* is the provision of financial assistance by the government to producers to encourage the production of certain goods/services.

Subsidies may be direct or indirect. Examples of indirect subsidies: subsidies on petrol and cooking oil. Refer to page 29 for more elaboration on indirect subsidy.

## 5.5. Effects of Indirect Subsidy

### On Equilibrium Price and Quantity

An indirect subsidy of \$s per unit of output lowers firms' marginal cost relative to marginal revenue. Firms, as rational profit maximisers, respond by increasing supply to capture the positive marginal profit. An increase in the market supply from  $S_0$  to  $S_1$  creates a surplus of  $uv$  at the original market price  $P_0$ , which results in the fall in equilibrium price from  $P_0$  to  $P_1$  and the rise in equilibrium quantity from  $Q_0$  to  $Q_1$ .

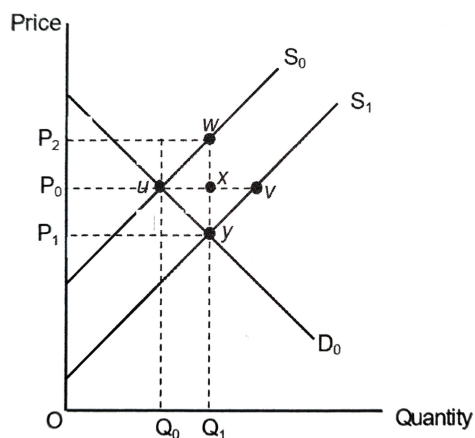


Figure 5.3.: Effect of an Indirect Subsidy (Specific Subsidy)

### On Government's Spending

govt.'s subsidy spending = subsidy per unit of output  $\times$  units of output = area  $P_1P_2wy$

## Implications of Government Spending

Spending on subsidies, without compensating spending cuts in other areas/tax increase, would lead to a worsening of the government's budget position.

For a government intent on keeping its spending under control, spending on subsidies in one industry would then have to come at the expense of other areas of spending e.g. education (opportunity cost). The government should therefore weigh the marginal social benefit and marginal social cost of spending on different areas to arrive at the optimal allocation of funds.

Alternatively, the government has to raise taxes to finance such spending, which could bring along other problems such as the erosion of incentive to work, save and invest.

## On Consumer Expenditure and Producer Revenue

### Consumer Expenditure

The indirect subsidy lowers the price consumers pay from  $P_0$  to  $P_1$ , incentivising budget-constrained utility-maximising consumers to increase quantity demanded from  $Q_0$  to  $Q_1$ .

As the price that consumers pay and the quantity bought change in opposite directions, the final effect on consumer expenditure depends on the PED.

### Producer Revenue

While producers receive from consumers price  $P_1$  per unit, they also receive from the government  $w$  per unit in indirect subsidies. The final price per unit received by the producers is  $P_2$ . Producer revenue increases from area  $OP_0uQ_0$  to area  $OP_2wQ_1$ .

As the price producers receive per unit of output increases as does quantity sold, with the subsidy, producer revenue increases regardless of PED.

## On Government's Microeconomic Goals of Efficiency and Equity

### Allocative Efficiency

If the market is efficient to begin with, government interventions that cause deviations from this market outcome must necessarily lead to a loss of economic welfare. Indirect subsidies hence distort price signals and lead to a loss of allocative efficiency.

### Equity

Indirect subsidies given to producers of necessities enables them to produce the goods and services at a lower cost and hence charge lower prices. Lower-income households experience greater purchasing power and have access to these necessities, improving equity.

However, subsidies may worsen equity as some subsidies are regressive in nature as they benefit high-income households. Petrol subsidies are particularly regressive, as higher-income households are more likely to own and drive cars. Lowering the price of petrol hence yields greater increase in the purchasing power of high-income households than lower-income households, worsening equity.

## Other Implementation Problems – Black Markets

Where an indirect subsidy lowers the price of the good in the country below the price of the same good overseas, it creates an opportunity for profits to be made by purchasing the good at a subsidised price at home and selling the good at a higher price in another country. Even if the government were to pass laws to prohibit the export of subsidised necessities, a high enough price differential will still create an incentive for smugglers to take the risk. The existence of black market therefore undermines the effectiveness of subsidies to keep necessities affordable and available to the locals. To ensure effectiveness of the policy, the government will have to step up efforts to conduct checks and enforce the rules, efforts which take scarce resources away from alternative uses.

## 5.6. Application of the PED to Study the Effects of Indirect Subsidy

### Effect on Consumer Expenditure

In addition to the explanation for the effect on consumer expenditure in Section 5.5.

Where demand is price elastic, the decrease in price brings about a more than proportionate increase in quantity demanded. With the subsidy, the decrease in consumer expenditure from the lower price paid per unit, area  $P_e P_0 e_0 c$ , is less than the increase in consumer expenditure from the increase in the number of units consumed, area  $Q_0 c e_2 Q_e$ . Hence, consumer expenditure increases from area  $OP_0 e_0 Q_0$  to area  $OP_e e_2 Q_e$ .

Where demand is price inelastic, the decrease in price brings about a less than proportionate increase in quantity demanded. The decrease in consumer expenditure from the lower price paid per unit, area  $P_0 e_0 d P_i$ , is greater than the increase in consumer expenditure from the increase in the number of units consumed, area  $Q_0 d e_1 Q_i$ . Hence, consumer expenditure decreases from area  $OP_0 e_0 Q_0$  to area  $OP_i e_1 Q_i$ .

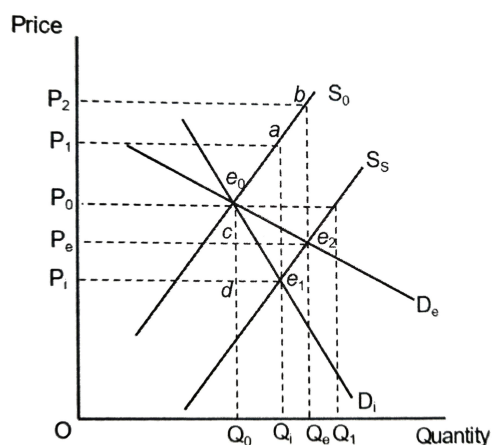


Figure 5.4.: Effect of Indirect Subsidy on Market Outcome



## Effectiveness of Indirect Subsidy in Lowering the Price of Goods

If the objective of the indirect subsidy is to lower the price of the good, the policy will be more effective with a more price inelastic demand. The more price inelastic the demand, the less responsive quantity demanded is to price changes. Hence, a large decrease in price is needed to induce a large enough increase in quantity demanded to eliminate the surplus, to establish a new equilibrium.

The indirect subsidy which increases supply and shifts the supply curve from  $S_0$  to  $S_s$  results in a greater decrease in price along ( $P_0P_i$  compared to  $P_0P_e$ ) along the more price inelastic demand curve  $D_i$  than along the price elastic demand curve  $D_e$ .

## Effectiveness of Indirect Subsidy in Encouraging Consumption

If the objective of the indirect subsidy is to encourage consumption, the policy will be more effective with a more price elastic demand. The indirect subsidy produces a greater increase in quantity exchanged ( $Q_0Q_e$  compared to  $Q_0Q_i$ ) along the more price elastic demand curve  $D_e$  than the price inelastic demand curve  $D_i$ .

The more price elastic the demand, the more responsive quantity demanded is to price changes. Hence, a smaller decrease in price ( $P_0P_e$  compared to  $P_0P_i$ ) will be sufficient to induce a large enough increase in quantity demanded to eliminate the surplus  $Q_0Q_1$  to establish a new equilibrium. Faced with the same supply curve  $S_s$ , the decrease in price leads to a decrease in quantity supplied.

## 5.7. Price Controls

**Definition 5.4.** *Price controls* refer to government-imposed restrictions on what can be charged for a good/service in the market.

Price controls are used when the equilibrium price is deemed as undesirable.

## 5.8. Price Ceiling

**Definition 5.5.** *Price ceiling* is the maximum legal price allowed by the government. No good/service can be bought/sold at prices above this upper limit.

A price ceiling is considered effective only if it is set below the free-market equilibrium price. Examples of markets that have been subject to price ceilings include apartments (rent control), gasoline, natural gas, food and prescription drugs.

## 5.9. Effects of Price Ceiling

### On Price and Quantity

In the absence of price controls, equilibrium price is at  $P_e$ , where quantity demanded equals quantity supplied and the equilibrium quantity is at  $Q_e$ . The government may, however, find the free market price too high and want to prevent prices from rising too fast so that low-income consumers can still afford the good. Hence, the government sets a maximum price (imposes a price ceiling).

## 5. Government Intervention in Markets

Suppose the government sets the price ceiling at  $P_c$ , preventing prices from reaching its market-clearing level. By holding price below the market-clearing level, the price ceiling incentivises budget-constrained, utility-maximising consumers to increase quantity demanded from  $Q_e$  to  $Q_d$ . It also means that units of output that can only be produced at higher marginal cost are no longer profitable, causing profit-maximising producers to reduce quantity supplied from  $Q_e$  to  $Q_s$  to avoid marginal loss. This creates a persistent shortage or  $Q_s Q_d$ .

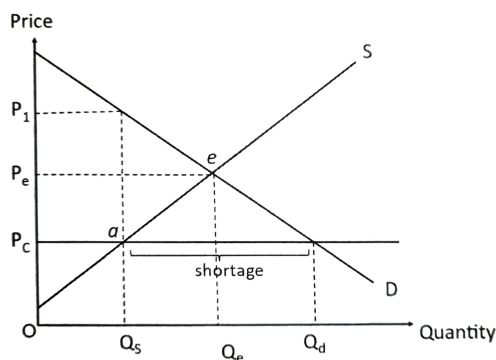


Figure 5.5.: Price Ceiling

### On Consumer Expenditure and Producer Revenue

The price ceiling depresses the price consumers pay and producers receive for each unit of the good. The quantity exchanged  $Q_s$  in the market is constrained by how much producers are willing and able to bring into the market. With the fall in price consumers pay and producers receive and a fall in quantity exchanged, consumer expenditure and producer revenue decrease from area  $OP_e Q_e$  to area  $OP_c a Q_s$ .

### On Government's Microeconomic Goals of Efficiency and Equity

#### Allocative Efficiency

If the market is efficient to begin with, government interventions that cause deviations from this market outcome must necessarily lead to a loss of economic welfare. Price ceiling hence distorts price signals and leads to a loss of allocative efficiency.

#### Equity

At the high price, constrained by their budget, low-income households without the ability to pay the higher price drop out of the market, leaving only those with the ability to pay to enjoy these essential goods and services. The price ceiling keeps the price of a good low and more affordable to low-income households, hence promoting equity.

In addition, an increase in the price of necessities represents a larger percentage of the incomes of low-income households than of higher-income households. This has a regressive effect, putting a greater squeeze on the purchasing power of low-income households than high-income households. By limiting the price increase with a price ceiling, the government seeks to counter the regressive effect.

That said, even if the government were to be successful in keeping the price down, fewer units of the good is available in the market with the price ceiling ( $Q_s$  compared to  $Q_e$ ). Hence, while the

good may be more affordable, benefitting some consumers, the decrease in availability of the good hurts other groups of consumers.

## Other Unintended Consequences

### Allocation by Alternative Means

With price ceiling creating a situation of persistent shortage, alternative ways to allocate the limited supply of goods must be found. Methods of allocation:

- **On a "first-come-first-served" basis, which is inefficient**
  - The opportunity cost of the time spent queuing and waiting will be the loss of output that could have been produced otherwise, leading to a fall in productivity.
- **Based on sellers' preferences**
  - This system is often considered inequitable as sellers themselves decide whom they will sell to and may discriminate among customers. Goods are kept "under the counter" and sold only to regular customers, relatives or friends.
- **Rationing through coupons**
  - Adopted if the government wishes to ensure a certain degree of fairness in allocating the final goods produced given the shortage created due to the imposition of a price ceiling.
  - Sufficient coupons could be printed to match the available quantity supplied  $Q_s$  and then distributed to buyers. They may be distributed equally or on the basis of age, sex, marital status or any other criterion. Whether the criterion set is equitable depends on the prevailing norms and standards.

### Emergence of Black Markets

Black markets develop when price controls artificially create price differential for goods between the controlled (official) price and the maximum price that buyers are willing and able to pay for the good/service.

Referring to [Figure 5.5](#), at  $P_c$ , quantity demanded is  $Q_d$  but consumers can only get  $Q_s$ , for which they are prepared to pay a price  $P_1$ . This creates an opportunity for profits to be made by selling the good illegally at the higher price in the black market. Price  $P_1$  is higher than the official price  $P_c$  as well as the initial market price  $P_e$ , undermining the policy objective of the price ceiling. To ensure the effectiveness of the policy, the government will have to step up efforts to conduct checks and put in place tough penalties to raise the marginal cost of smuggling relative to the marginal benefits. This, however, takes scarce resources away from alternative uses.

### Quality Deterioration

A ceiling on prices will likely lead to deterioration of the quality of goods and services. Without the ability to raise prices, firms, in pursuit of profits, seek to cut cost. The cost-cutting could take many forms such as switching to lower-grade materials, reduction in portion size, etc. The result is a decline in consumer utility and the loss of economic welfare. The government can combat this by issuing specific product standards. However, such government intervention comes at a high cost, in terms of the need for additional manpower for quality and enforcement checks.

### **Reduction in Market Supply in the Long Run**

While producers may respond to temporary low prices by cutting back output, if the situation of low prices persists, producers could choose to leave the industry altogether in the long run. This is because higher profits in alternative industries which do not face price controls raises the opportunity cost of staying on in the existing industry. As firms exit the industry in the long run, market supply declines, exacerbating the shortage. This results in higher market prices, meaning lower-income households will not be able to purchase these goods and services.