YISHUN INNOVA JUNIOR COLLEGE
2024 JC1 H1 ECONOMICS
Lecture Notes

Topic 3:

Market Failure and Government Intervention

Contents

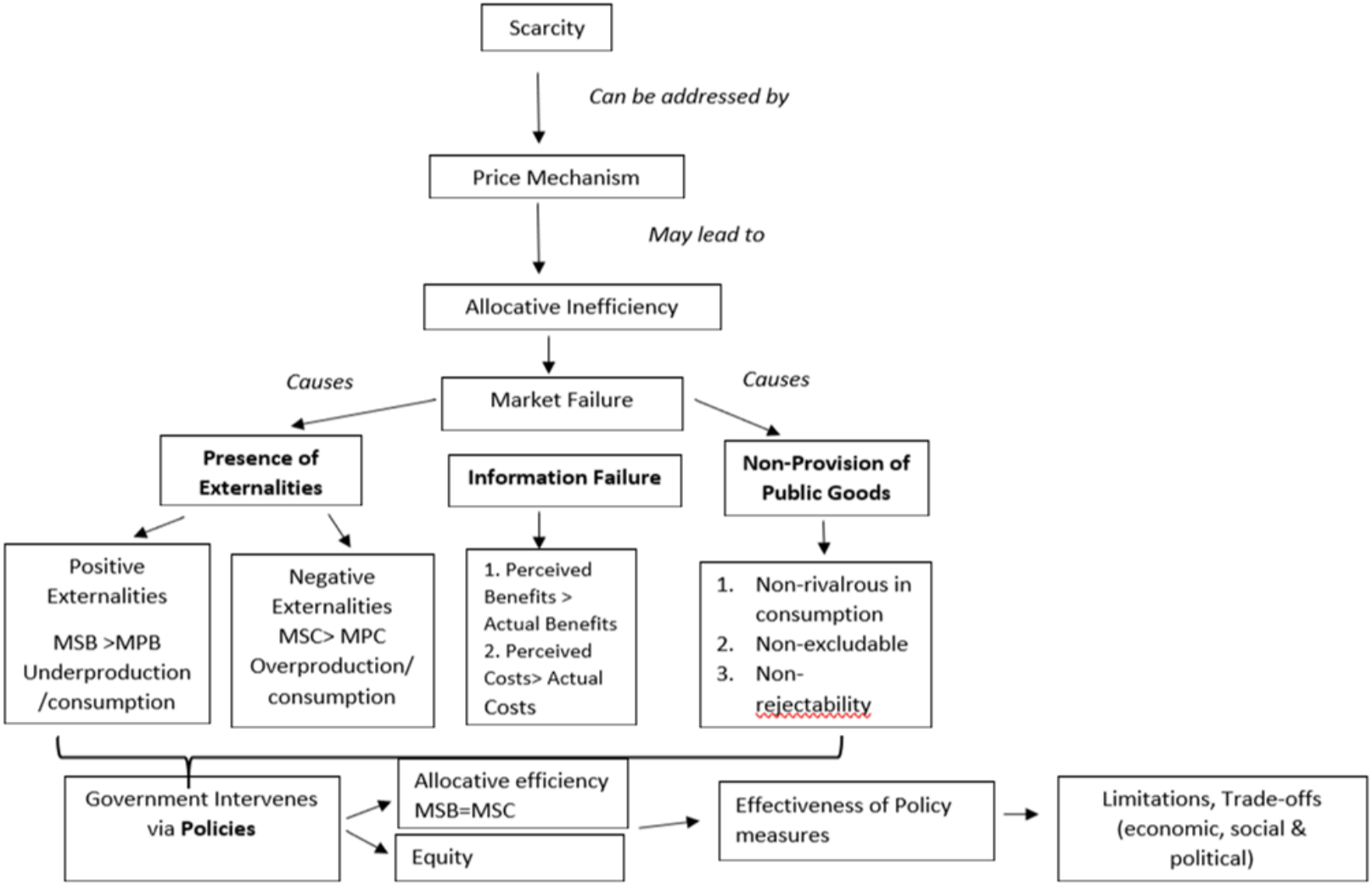
SUGGESTED READINGS

1. Sloman, J., Garratt, D., & Guest, J. (2018). Economics (10th Edition), Chapter 10 & 11, Pearson Education.
2. Mankiw, G, Quah, E & Wilson P (2021). Principles of Economics, An Asian Edition (3rd Edition), Chapters 10 & 11, Cengage Learning Asia Pte Ltd.
3. O'Sullivan, A., Sheffrin, S. M., Lim, K. L., Seevaratnam. V (2007). Principles of Economics. Pearson Education. Chapter 8.
4. Sexton, Robert L. (2010). Exploring Economics 5th Edition, Cengage Learning. Chapter 8 & 9.
5. Thaler, R. H. (2015). *Misbehaving: The Making of Behavioural Economics*, Chapter 8. Penguin Random House UK.

LEARNING OBJECTIVES

At the end of the topic, students will be able to		☑
1.	State and describe government's microeconomic objectives concerning resource allocation in the market.	
2.	State the conditions that is required for decisions made by firms and consumers in the free market to bring about desirable market outcomes (i.e. allocative efficiency and/or equitable distribution of resources).	
3.	Explain the causes of market failure and how market outcomes can be inequitable.	
4.	Explain how decisions made by firms and consumers in the free market can lead to undesirable market outcomes (e.g. allocative inefficiency and/or inequitable distribution of resources)	
5.	Explain the concept of deadweight loss in relation to market failure.	
6.	Explain the policy decisions undertaken by governments to achieve microeconomic objectives in relation to efficiency and equity.	
7a.	Explain with examples and diagrams, how policy measures including taxes, subsidies, quotas and tradeable permits work to achieve government's microeconomic objectives (e.g. Reduce allocative inefficiency and inequity).	
7b.	Explain with examples and diagrams, how policy measures including joint and direct provision, rules & regulations, public education and improving quality and access to information work to achieve government's microeconomic objectives (e.g. Reduce allocative inefficiency and inequity).	
8.	Apply the DM framework to explain and evaluate the effectiveness, feasibility, and appropriateness of government policies.	

TOPIC CONCEPT MAP



1 INTRODUCTION

In the previous topic, we examined how the free market addresses the central economic problem - *Scarcity*. More specifically, we explored how price mechanism, through free market forces of demand and supply, operate to achieve *allocative efficiency*.

Allocative efficiency is achieved when resources are allocated to produce the combination of goods and services that **maximises society's welfare** (i.e. when consumers and producers collectively maximise their gains/welfare.) We can therefore say that there is a **social optimum** outcome when allocative efficiency is achieved in the free market.

definition

Social optimum output refers to the level of output where society's welfare is maximised, (i.e., the outcome is allocatively efficient.)

Consumers' and producers' welfare is represented by consumer and producer surplus. **Hence, allocative efficient outcomes in the market also implies that consumer and producer surpluses are maximised.**

However, the efficient market outcome will only occur under the following strict conditions:

- **Absence of public goods** (i.e. All goods are private goods)
- **Absence of externalities** (i.e. Market accounts for all the benefits and costs)
- **There is perfect information** (i.e. Economic agents have perfect information)
- **There is perfect competition** (i.e. Market is perfectly competitive)
- **There is perfect factor mobility** (i.e. Factors of production are perfectly mobile)

When these conditions do not hold in the real, we describe the situation as **market failure.**

definition

Market failure is an economic situation in which **the free market fails to allocate resources efficiently** towards the production / consumption of the combination of goods & services, which **maximises society's welfare.**

In this topic, we will explore the various causes and consequences of market failure. We will see that it provides a major argument for government intervention in the free market. Thereafter, we will examine how governments may correct these market failure and improve resource allocation through public policy measures while recognising the costs, limitations, unintended consequences and possible trade-offs of the intervention.

Before that, let us gain an understanding of the concepts of private (market) optimum and social optimum. This will help us better grasp the concept of market failure.

2 PRIVATE & SOCIAL OPTIMUM OUTPUT

Refer to Section A, Activity sheet 1

In the free market, decisions are made by rational economic agents (i.e. consumers and producers) who make decisions at the margin (i.e. weigh consider their marginal cost and marginal benefit).

2.1 Private Optimum Output (Q_p)

A rational decision maker would engage in an activity only if the benefits from doing so exceeds any costs involved. Applying the marginalist principle, a rational decision maker will:

- do a little more of an activity, if the additional benefits gained from the activity outweighs the additional cost incurred from it; or
- do a little less of the activity, if the additional costs incurred from the activity outweighs the additional benefits gained from it.

Figure 1 shows the *private optimum* output (Q_p) of a consumer/producer.

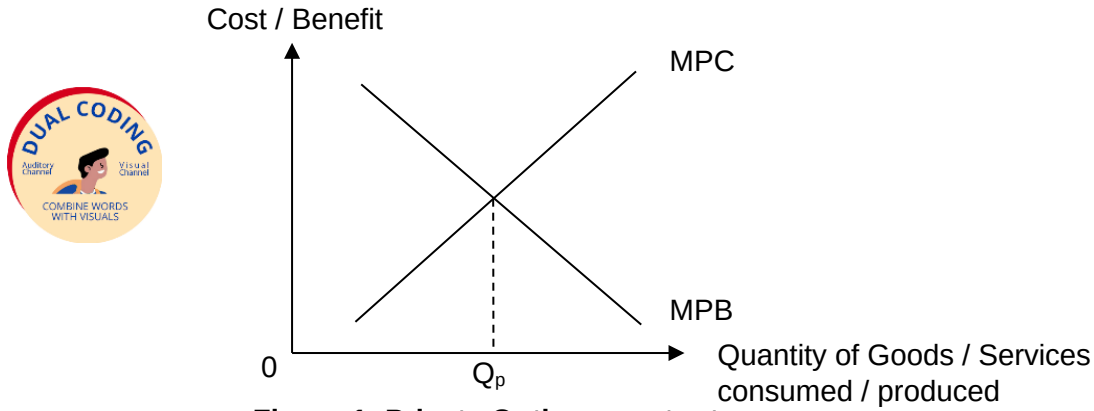


Figure 1: Private Optimum output

- The Marginal Private Benefit (**MPB**) reflects either consumers' **additional benefit** (i.e. satisfaction or utility) from consuming the last unit of the good / service, or producers' additional benefit from producing and selling (i.e. revenue) the last unit of the good / service.
- The Marginal Private Cost (**MPC**) in turn reflects both consumers' **additional cost** to consume the last unit of good / service, or the additional cost incurred by producers to produce and sell the last unit of the good / service.

Since consumers and producers aim to **maximise their self-interest (utility and profits respectively)**, the optimal level of consumption / production occurs when MPB = MPC, where their welfare is maximised. This occurs at output, **Q_p.**

Consumers	Producers
Aim: To maximise utility (satisfaction).	**Aim:** To maximise profits.
To do so, consumers will consume to the point where their Marginal Utility (MU) = Marginal Cost (MC)	To do so, producers will produce to the point where their Marginal Revenue (MR) = Marginal Cost (MC)
Which can be generalised as Marginal Private Benefit = Marginal Private Cost **(MPB) = (MPC)** **Note:** (MPB=MPC) is applicable to any economic agent (i.e. both consumer and producer)	

2.2 Social Optimum Output (Qs)

The socially optimal level of output is the output where social welfare is maximised. This occurs where **Marginal Social Benefit (MSB) = Marginal Social Cost (MSC).**

definition

***Marginal social benefit (MSB)**: the gain in welfare by the whole **society** when an additional unit of good is produced or consumed.*

***Marginal social cost (MSC)**: the cost that **society** incurs when an additional unit of the good is produced or consumed.*

IMPORTANT

Society consists not only of consumers and producers directly involved in the consumption and production of goods, but also includes ***third-parties*** who are individuals or group affected by market activity, even though they are **not directly involved in the consumption and production of the good / service.** They experience either external benefits or external costs.

Since

- **MSB** refers to the additional benefit to society from an additional unit of consumption/production, it would include the additional benefits to both the consumers/producers directly involved in the market activity as well as third-parties who are not directly involved.
  i.e. Marginal social benefit = Marginal private benefit + Marginal external benefit
  or **MSB = MPB + MEB**

Note:

- **Private benefit** refer to the benefits enjoyed by consumers in consumption of the good, or producers in the production of the good.
- **External benefit** refer to the spillover benefits on third parties not involved in the consumption or production of the good.

Similarly,

- **MSC** refers to the additional cost to society from an additional unit of consumption/production. It would include the additional costs to both the consumers/producers directly involved in the market activity as well as third-parties who are not directly involved.
  i.e. Marginal social cost = Marginal private cost + Marginal external cost
  or **MSC = MPC + MEC**

Note:

- **Private cost** refer to the costs incurred by consumers in consumption of the good, or producers in the production of the good.
- **External cost** refer to the spillover costs on third parties not involved in the consumption or production of the good.

To understand why the socially optimum level of output is at $0Q_s$ where MSB = MSC, we need to consider situations when MSB ≠ MSC. This can be seen diagrammatically in Figure 2.

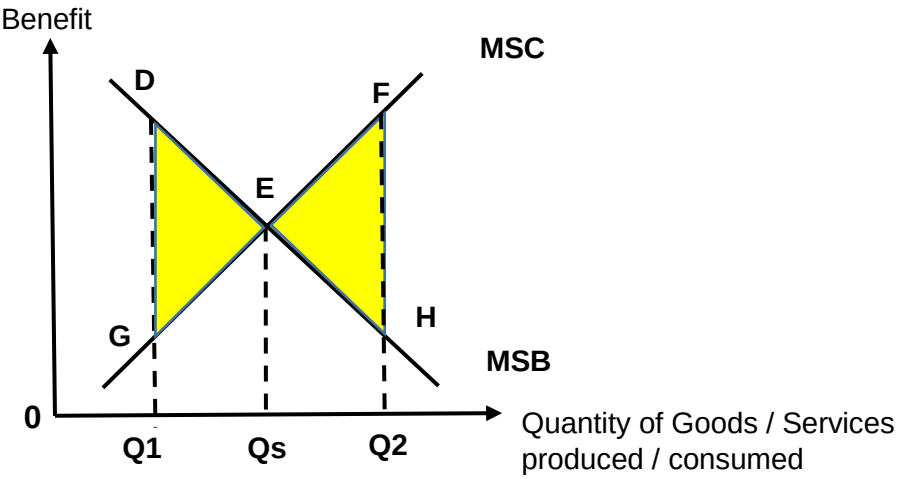


Figure 2: Social Optimum output

Under-consumption / production at output $0Q_1$ (MSB > MSC)

- In Figure 2, at $0Q_1$, the MSB derived from the unit of good (i.e. point D) is greater than the MSC incurred (i.e. point G). This means that for the last unit of output consumed / produced, the additional benefit to society is greater than the additional cost to society incurred from consuming / producing this unit of the output.
- If the market output is only $0Q_1$, the gap between $0Q_1$ and $0Q_s$ represents an under-consumption / production of the good that results in a **deadweight loss of area DGE (shaded portion).**
- This is because the consumption / production of an additional unit of the good would result in an increase in net benefit to society.
- Hence, society's welfare is not yet maximised and society can be better off (i.e. greater welfare can be enjoyed) if **consumption / production level is increased.**

Over-consumption / production at output $0Q_2$ (MSB < MSC)

- In Figure 2, at $0Q_2$, the MSC incurred from the unit of good (i.e. point F) exceeds MSB derived (i.e. point H). This means that for the last unit of output consumed / produced, the additional benefit to society is less than the additional cost to society incurred from consuming / producing this unit of the output.
- If market output is at $0Q_2$, the gap between $0Q_2$ and $0Q_s$ represents an over-consumption / production of that good, that results in a **deadweight loss of area FEH (shaded portion).**
- This is because the consumption / production of an additional unit of the good would result in net cost to society.
- Hence, society's welfare is not maximised and society would be better off (i.e. greater welfare can be enjoyed) if **consumption / production level is decreased.**

Socially optimal level of output at $0Q_S$ (MSB = MSC)

- Using the marginalist approach, one would realise that society's welfare increases as output move towards 0Qs. That is, only at output level $0Q_s$ social welfare is maximised.
- At 0Qs, MSB = MSC, and there is no tendency to deviate as any change in consumption or production level would result in a decrease in social welfare.

3 SOURCES OF MARKET FAILURE

Equipped with the various frameworks in the previous sections, we can now examine the various sources of market failure and look at the various policy measures to tackle them.
Subsequent sections examine the following sources of market failure:

- **Presence of public goods** (i.e. Non-provision of public goods)
- **Presence of externalities** (i.e. Spillover costs and benefits to third-parties)
- **Imperfect information** (i.e. Economic agents have imperfect information)
- **Imperfect competition** (e.g. Presence of market dominance by large firm(s))
- **Imperfect factor mobility** (i.e. Factors of Production are immobile)

3.1 Non-Provision of Public Goods

Refer to Section B, Activity sheet 1

The most extreme case of market failure arises when the free market does not allocate any resources to the production of the good/service at all. In such cases, the private equilibrium quantity equals to zero and the society suffers a maximum welfare loss as the good/service which is valued by the society is not produced for consumption at all.

One such case of this *complete market failure* is in the non-provision of **public goods**. Public goods/services are valued by society but have three distinct features of **(1) non-rivalrous in consumption**, **(2) non-excludable in consumption** and **(3) non-rejectability.**

definition

Non-rivalrous in consumption refers to the situation in which consumption or use of a good / service by a consumer does not reduce the availability of the good for others. In other words, consumption by **a consumer does not diminish the quantity and / or quality available to another consumer.**

- When a good is non-rivalrous in consumption, there is no additional cost to supply the good /service to one more consumer. This means marginal cost (MC) of providing the good / service for an additional user is zero.
- In order to achieve allocative efficiency in this market, the price must be equal to MC, which is zero. **Hence, P = MC = 0.**
- However, producers who are profit motivated will have no incentive to supply the good when the price is zero. So, there is **no effective supply.**

definition

Non-excludability in consumption refers to the situation in which consumption or use of the good / service **cannot be limited to the consumers who have paid for it**. In other words, a good is non-excludable in consumption when it is very difficult or costly **to exclude anyone from enjoying the benefit of a good once it is made available, even if he / she refuses to pay for it.**

- Because consumers know they can benefit from the public good without having to pay, a **problem of free-ridership** will arise whereby the non-payers benefit from the consumption of the public good / service without paying for it.
- If consumers know they are able to free-ride, they will not be willing to pay for the public good / service. So, there is **no effective demand**.

definition

Non-rejectability in consumption refer to the inability of consumers to refuse the consumption of a good once it has been provided. Once the public good is provided, everyone benefits from or is affected be it. It cannot be rejected by consumers/beneficiaries.

- Non-rejectability is a third and additional characteristic to be used only when relevant.
- For example, when a certain level of deterrence to external threats is created by the provision of national defence, a person residing in that country will not be able to refuse the safety created even if he wants to. Unlike the case of a private good, which the consumer can reject the consumption of the good if he/she has no preference for it.

These three characteristics are important to differentiate private goods which consumers purchase and public goods which are typically offered/provided to the society.

Examples: 

Refer to Section B, Activity sheet 2

The table below explains the characteristics using street lighting and tsunami warning system as examples of public goods.

Features	Examples	
	Street Lighting	**Tsunami Warning System**
Non-rivalry in consumption: where one additional consumer does not diminish the quantity and quality available for other consumers.	With the street lightings set up, a pedestrian enjoying the luminosity does not dim or reduce the availability of the street lighting for other pedestrians.	Once a tsunami is detected and the alert is sounded, all in the vicinity can hear it. A resident receiving the tsunami alert will not reduce the volume of the warning signal received by other residents.
Non-excludability in consumption: where it is very difficult or costly to exclude non-payers from enjoying the good/service	If a producer installs street lighting and attempts to charge pedestrians for the usage of the well-lit road, it will be extremely costly to set up a road system to exclude non-payers from using it.	If a producer sets up a tsunami warning system, it is very costly/not possible to exclude non-payers such as tourists from hearing the siren when tsunami is about to strike, if he / she happens to be in the vicinity.
Non-rejectability in consumption: where once a public good is supplied, it cannot be rejected by consumers.	Once street lightings are available, a pedestrian walking on the lit pathways cannot reject the consumption of (and hence benefits derived from) street lightings.	Once the warning system is available, a resident or tourist in the vicinity cannot reject the benefits (i.e. being warned) of the impending tsunami.
In both cases, given the characteristics, • There is no effective demand and supply. • The free market fails because the market demand and supply are **non-existent.** • **There is a 'missing' market /** no market to allocate any resources for the production of the public good/service leading to a **complete market failure**. • Once the good is provided, consumers cannot reject the consumption of the good.		

Please complete question in Section B, Activity sheet 3
(Click and Drop Activity: Public vs. Private goods)

3.1.1 Practice Question on Public Goods (Causes & Consequences)

1. Standing 12m high, Johor Straits lighthouse, or otherwise known as Raffles Marina lighthouse, sits at the tip of Raffles Marina and overlooks the Tuas Second Link, Singapore's second causeway to Malaysia. The light emitted from the lighthouse is visible over long distances and helps to guide ships navigating into and out of the marina or away from dangerous rocks.

(i) Explain why a lighthouse is considered a public good.

(ii) Briefly explain why the market for lighthouses would be 'missing' without government intervention.

3.1.2 Policy Intervention for Non-Provision of Public Goods

Refer to Section C, Activity 1

a) Direct Provision of Public Goods

Explanation of policy, i.e. how the policy works

In order to correct the non-provision of public goods / services, the government could **directly provide** the public good / service that would not be produced by private producers.

Alternatively, the government could pay private firms produce the goods. However, it remains a case of direct provision as the decision and the cost to supply (as well as other decisions related to supply – for instance, the amount to produce, the quality of good / service to be provided) the good is undertaken by the government.

Source: sgcarmart.com

The Land Transport Authority (LTA) is in the midst of replacing street lamps with energy-efficient light emitting diodes (LED). The replacement of 4,000 lights at 500 low-traffic and residential roads has been completed since 2018. The provision and maintenance of more than 95,000 streetlights along public roads, back lanes and service roads by LTA is financed by taxes that the Singapore government collects.

However, it is important to note that when the government provides a good directly, it does not necessarily produce the good. In the real world, the government may subcontract the provision of such goods / services to private firms for a fee, i.e. the government pays a firm to produce.

In this example:

- The government allows private producers to submit tenders to produce, install and maintain street lamps for the government but the **full cost is covered by the government** and the firm is not charging consumers for using the good as it would be impossible to do so.
- LTA also provides guidelines that must be adhered by private producers who are interested to produce the street lamps for the government.

By providing the socially optimal quantity of street lighting at where MSB = MSC, allocative efficiency can be attained with public provision.

Government will always wish to implement the most appropriate policy that can resolve the economic problem. A policy is **most appropriate** if it have a **high level of effectiveness and feasibility as well as with minimum negative unintended consequence**.

The governments can use the following categories of criteria (which you learned under the decision-making framework in Topic 1) to help them assess the extent of effectiveness and feasibility and in turn the appropriateness of carrying out the policy action:

- **Government objectives**
- **Potential benefits and costs** (including opportunity costs) of the intervention.
- **Information & Constraints** including resources (e.g. financial), technical, and political.
- **Intended and unintended consequences** (including trade-offs).
- **Other limitations** (e.g. Policy does not addresses root cause of the problem)

Government's Factors of Consideration

EXTENT OF EFFECTIVENESS	The measure is a direct way to solve the problem of non-provision since no private firm would ever provide such good / service, thus reducing allocative inefficiency. Government's information failure: **(-)** However, governments will still have to decide the amount to produce and may be subjected to **information failure**. The policy measure **may not be effective to entirely correct the market failure,** if the government is **unable to accurately estimate the socially optimal quantity** of these goods and services. Hence, while social welfare may improve with direct provision, governments may not have **effectively maximised social welfare.**
DEGREE OF FEASIBLILITY: Constraints (Whether the policy is doable/viable in terms of (1) resources, (2) financial budget and (3) knowledge and technical capability)	Financial Constraint: **(-)** Direct provision however requires the government to **bear the full cost of the project.** There is a need to fund the maintenance and continuous provision of these goods as well. For governments who have high public debt or experiencing severe deficits in the past years, they might not have sufficient reserves to directly provide the good / service at the socially optimal quantity to remove the social welfare loss, especially in the long run. Hence the implementation of this policy may be less feasible. Knowledge and technical capability: **(+)** Direct provision may be feasible as governments **need not necessarily produce the good if they do not have the expertise**. They can outsource the job to private firms which has the expertise on the subject matter. Hence still allowing the public good to be provided. **(-)** The lack of expertise in running businesses and the lack of profit, would result in higher costs and inefficiency in the provision of the good by government, which is ultimately borne by the taxpayers. *(Note: this is **unintended consequence** only if the government choose to outsource the production of the good to private firms due to the lack expertise)*

UNINTENDED CONSEQUNCES:	Productive Efficiencies: **(+)** When the government takes over the production, the average costs to supply goods and services could be lower as costs savings can be enjoyed from bulk purchase of goods, equipment, etc**.** **(-)** However, government provision can also lead to **productive inefficiencies** due to bureaucratic red tape. In addition, the absence of profit incentives suggests that public sector agencies may not be as motivated to minimise costs or innovate as private companies are. Hence, this may lead to unnecessary higher costs of providing public goods. Opportunity cost: **(-)** Direct provision is the only solution to the problem of non-provision of public goods. But it can come at the expense of high opportunity costs. Opportunity cost is incurred for every choice made by the government (e.g. The provision of a public good like flood warning system would incur government expenditure that could have been channelled elsewhere, such as the provision of education facilities.) This will result in government having to reduce the expenditure on other sectors (e.g. on education services), in turn, forging the increase in labour productivity and economic growth. Alternatively, government may choose to limit the funds available for the provision of the public good, thus not being able to provide to the socially optimal level and in turn limiting the effectiveness of the policy in resolving the market failure.
EXTENT OF APPROPRIATENESS • Assuming the government has sufficient budget, direct provision is an appropriate policy measure to tackle the non-provision of public goods. • This is because direct provision will be effective and is the only solution to non-provision of public goods.	

3.1.3 Practice Question on Policy Intervention (Public Goods)

Instructed in Section C, Activity 2

Q1: Adapted from 2018 HCI H1 Prelim Q1

Climate Change & Dam

The world has spent an estimated $2 trillion on dams in recent decades, with each dam costing more than $1.5 billion. Many nations see dams as an important way to fight climate change – dams are built to control floods, improve irrigation, alleviate water shortages, and generate low-carbon hydroelectricity to replace power stations that burn fossil fuel. But recent findings by experts seem to suggest otherwise.

Besides, hydroelectric dams contribute more to global warming than previously estimated, according to a study published in BioScience. Researchers found that rotting vegetation in the water means that the dams emit about a billion tonnes of greenhouse gases every year. This represents 1.3% of total annual human-caused global emissions. When considered over a 100-year timescale, dams produce more methane than rice plantations and biomass burning, the study showed.

(a) Explain why price mechanism fails to produce public goods such as dams. [6]
(b) Discuss the factors that a government should consider when deciding to build a new dam. [8]

3.2 Presence of Externalities

Another source of market failure is in the case of goods with externalities when consumed / produced.

definition

An **externality** is an **uncompensated spillover/third-party** effect (costs or benefits) arising from the consumption or production of a good / service.

- Recall a third-party is a person not directly involved in the production or consumption of the good / service, i.e. someone other than the consumer or producer of a good / service.
- Also recall that for the free market allocative efficient, the current combination of goods produced and sold in the market should derive the maximum satisfaction for each consumer at their current levels of income.
- However, this is only true under the assumption that there are no additional costs or benefits to the society.

- In the case of goods with externalities, the consumption or production decisions made by economic agents (i.e. consumers and producers) results in **external costs and / or benefits which affect other members of the society** (i.e. third parties).
- While these decisions may be in the best self-interests of the consumers and producers involved, it may not be in the interest of other parties in the society, and hence may not maximise society welfare.

Let's begin by looking at the case of positive externalities.

3.2.1 Positive Externalities

SINGAPORE Student Learning Space

Refer to Section D, Activity sheet 1

definition

Positive externalities can be defined as **third-party benefits** resulting from the consumption / production of a good / service.

RETRIEVAL PRACTICE – PRACTICE BRINGING INFORMATION TO MIND

MSB = MPB + MEB (Marginal External Benefit)

If there is existence of MEB, then, MEB > 0, making MSB > MPB

The existence of external benefits results in **social benefits associated with consuming / producing a good being greater than its private benefits**.

Positive externalities can arise from the consumption or production of goods/services. The existence of positive externality in consumption / production results in a **divergence between private benefit and social benefit at all levels of outputs**, since there are **additional benefits accrued** to the society not taken into account by the consumer / producer in their consumption / production decision.

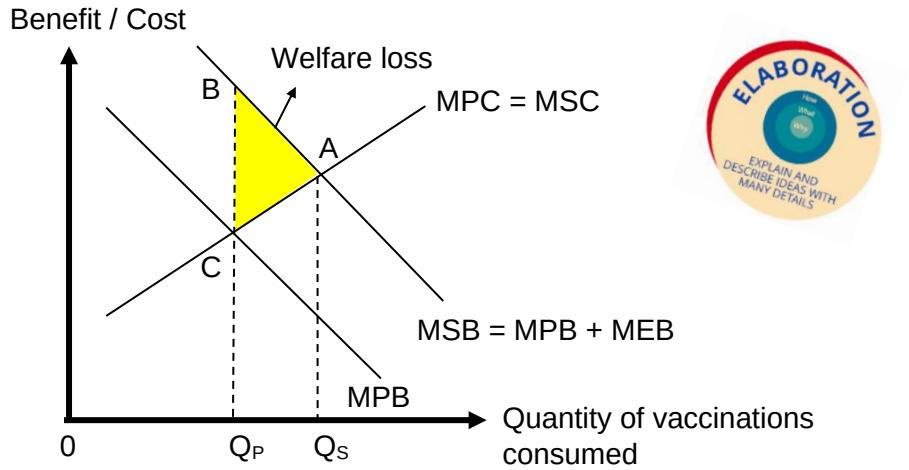
This implies that, without government intervention, the free market outcome of such good is not allocative efficient, since society's welfare is not maximised.

3.2.1.1 Positive Externalities in Consumption

Refer to Section D, Activity sheet 2

Positive externalities in consumption arises when there are third-party benefits as a result of the consumption of a good /service.

An example of positive externality in consumption is the consumption of flu vaccinations. Below is a detailed explanation of the market failure in the case of flu vaccination.

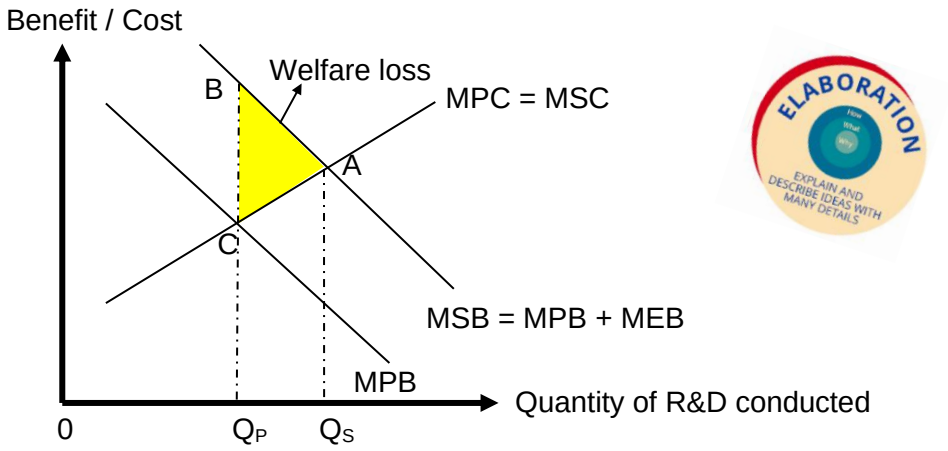
How Positive Externalities in Consumption Lead to Market Failure	
Diagram	 **Figure 3: Positive Externalities resulting in Market failure**
Step 1 Private optimal equilibrium where MPC = MPB	The marginal private benefit (MPB) to a consumer of flu vaccination could be the lower probability of having flu and hence being sick, therefore saving on medical expenses for the consumer, while the marginal private costs (MPC) to the consumer is the associated cost of taking a flu vaccination. In a free market without government intervention, **the consumer maximises his/her own welfare by consuming $0Q_p$ amount of vaccination where his/her MPB = MPC. Therefore, the private optimum output for him/her is at $0Q_P$.**
Step 2 Identify and explain the source of market failure using examples, *(i.e. identify the consumers, producers, third party involved and the external effects).* Using the diagram, explain effect of positive externalities on MPB and MSB	Assuming that there are no negative externalities, MPC equals to marginal social costs (MSC). Consumption of flu vaccination however **generates positive externalities in consumption (MEB).** Vaccinations actually help prevent the spread of flu viruses to the community at large. People are now less likely to be infected as there is one less person who has the potential to transmit the virus. **The community at large benefits from lesser medical expenses spent, and the economy benefits since less man-hours is lost due to workers being ill (e.g. No loss in labour productivity)** The presence of MEB causes a **divergence between the marginal social benefit (MSB) and MPB, where MSB is higher than MPB.** This is illustrated in Figure 3 where the MSB lies above the MPB, with the vertical distance between MPB and MSB representing the MEB.

Step 3 Identify MSC & MSB at output 0Qp to identify that there is under consumption.	At $0Q_P$, MSB > MSC. This means that at output $0Q_P$, society benefits more from consuming an additional unit of flu vaccination than the cost it would incur. **Hence, net benefit to society/social welfare can be increased with greater level consumption of vaccination.**
Step 4 Social optimal equilibrium where MSC = MSB	The socially optimum level of output, $0Q_S$, occurs where MSC = MSB. Hence, when left to the market forces, there is under-consumption of flu vaccination by Q_PQ_S amount.
Step 5 Identify the welfare loss area on the diagram and link back to the question	By summing the excess of MSB over MSC for the units Q_PQ_S, we arrive at a monetary measure of welfare loss (also known as deadweight loss) of area ABC to the society.
Step 6 Answer the question	As a result, the underconsumption of vaccination leads to market failure and may require government's intervention.

Refer to Section D, Activity sheet 2

3.2.1.2 Positive Externalities in Production

Similarly, positive externalities in production causing market failure can be explained using the example of Research and Development (R&D).

How Positive Externalities in Production Lead to Market Failure	
Diagram	 **Figure 4: Positive Externalities resulting in market failure**
Step 1 Private optimal equilibrium where MPC = MPB	The marginal private benefit (MPB) to a producer/firm of engaging in Research and development (R&D) could be more efficient production methods, which results in cost savings and increased profits; while marginal private cost (MPC) could be the cost of capital or manpower that is invested into engaging in R&D. In a free market without government intervention, the **firm maximises its profits by engaging in $0Q_p$ amount of R&D where MPB = MPC**. Its private optimal output of R&D is therefore at $0Q_P$.

Step 2 Identify and explain the source of market failure using examples, *(i.e. identify the consumers, producers, third party involved and the external effects).* Using the diagram, explain effect of positive externalities on MPB and MSB	Assuming that there are no negative externalities, MPC equals to marginal social costs (MSC). R&D however generates **positive externalities in production.** For instance, the development of a more advanced remanufacturing processes through R&D by AmpTec Industrial Heating Pte Ltd will benefit the third parties (i.e. other firms), as when these other firms adopt the same method, it will also be able to benefit from cost savings and greater profits. The economy also gains as more efficient production methods lead to an overall increase in economic productivity and economic growth. The presence of MEB causes a **divergence between the marginal social benefit (MSB) and MPB, where MSB is higher than MPB**. This is illustrated in Figure 4 where the MSB lies above the MPB, with the vertical distance between MPB and MSB representing the MEB.
Step 3 Identify MSC & MSB at output 0Qp to identify that there is under-production.	At $0Q_P$, MSB > MSC. This means that at output $0Q_P$, society benefits more from an additional unit of R&D than what it would cost society to produce it. Social welfare can be increased with an increased production of R&D.
Step 4 Social optimal equilibrium where MSC = MSB	The socially optimum level of output, $0Q_S$, occurs where MSB = MSC. Hence, when left to the market forces, there is an under-production of R&D by Q_PQ_S amount.
Step 5 Identify the welfare loss area on the diagram and link back to the question	By summing the excess of MSB over MSC for the units Q_PQ_S, we arrive at a monetary measure of welfare loss (also known as deadweight loss) of area ABC to the society.
Step 6 Answer the question	As a result, the underproduction of R&D leads to market failure and may require government's intervention.

3.2.1.3 Practice Question on Positive Externalities (Causes & Consequences)

Q1) Adapted from 2020 NYJC H1 Prelim P1Q1

Extract 1: Benefits of Formal Education

Formal schooling increases earnings and provides other individual benefits. However, societal benefits of education may exceed individual benefits. Research finds that higher average education levels in an area are correlated with higher earnings, even for local residents with minimal education. Science, technology, engineering, and mathematics graduates appear to generate especially strong external effects, due to their role in stimulating innovation and economic growth.

Source: Iowa State University, 2018

(a) With the aid of a diagram, explain why there is an inefficient allocation of resources in the market for formal education. [6]

3.2.1.4 Policy Intervention for Goods with Positive Externalities

	Policies to correct market failure due to the presence of Positive externality
(a)	Subsidies
(b)	Direct / Joint Provision
(c)	Legislation / Rules and Regulation

a) Subsidies

Refer to Section E, Activity sheet 1

Explanation of policy, i.e. how the policy works

Subsidies can be given to producers or consumers to overcome market failure caused by the presence of goods with positive externalities (in production or consumption).

By providing a **per-unit subsidy** that is **equal to the MEB** at $0Q_S$ **(**the vertical distance between MPB and MSB):

- the subsidy provides the same effect as decreasing the marginal private cost of production / consumption.
- Thus, the subsidy shifts the respective agent's **MPC vertically downwards** by the full amount of the subsidy to "MPC – subsidy" curve.
- The new private optimal output level where MPC' equates to MPB is now at $0Q_P$', which coincides with $0Q_S$.
- This means that producers or consumers will now increase production or consumption to the socially optimal level $0Q_S$. Thus, allocative efficiency is attained.

This is shown in Figure 5.

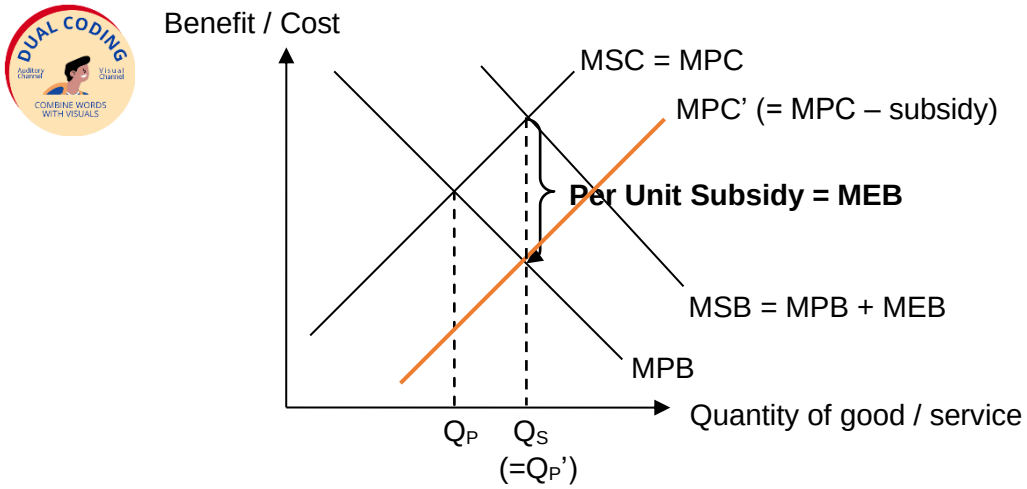
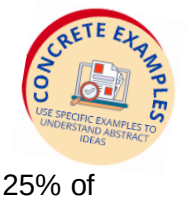


Figure 5: Effect of subsidy

Hence, providing subsidies has the aim of **encouraging/incentivising production / consumption up to the socially optimum level of output.**

Examples



- Undergraduate studies cost about $30,000 a year. The Singapore government subsidises these fees by close to 75%.
- In Singapore, all public outpatient services are subsidised; patients generally pay about 50% of the cost. Children and the elderly (over age sixty) pay only 25% of the cost.
- Singapore government subsidises the production of cultural performances (which has positive externalities) through National Arts Council so that it is more affordable for consumers in order to encourage consumption.

Government's factors of consideration

Refer to Section E, Activity sheet 2

Extent of Effectiveness	Flexibility to adjust policy **(+)** Government could decide on the amount of subsidy given based on the amount of MEB (which may differ based on the different groups of people and/or when the subsidy is given etc.) It is relatively easy to adjust amount/when/how the subsidy is given. **The flexibility hence adds to the effectiveness** of the policy increasing consumption/ production to the socially optimal level. Comparison to other policies: Degree of autonomy within the market (+) Subsidy is a market-oriented measure which allows markets to continue to play a role in resource allocation and bring about consumer sovereignty (where consumers can reflect their preference). *Recall that market is an efficient system to allocate resources.* This is in contrast to other more interventionists measures such as direct provision in the case of public goods for example or regulations (the following section). Responsiveness of economic agent: PED **(-)** Subsidy however works through the market. Effectiveness of subsidies is thus dependent on the responsiveness of economic agents in the market, which also varies depending on the nature of the good. It may or may not increase output significantly. (i.e. If demand for the good is price inelastic (PED < 1), consumers are less responsive to price changes and hence a significant amount of subsidy may be needed to achieve the desired rise in consumption/ production to the socially optimal level.) Government's imperfect information **(-)** In addition, under conditions of imperfect information in the real world, it may not be easy to accurately estimate the value of MEB. Under-valuation of MEB implies that the increase in output will not be sufficient to bring it to the socially optimal level to maximise society's welfare. An over-valuation of the MEB implies that although output is increased, it will result in over-consumption or over-production and welfare is again not maximised and scarce government resources will be wasted.

Degree of Feasibility	<u>Financial constraints</u> (-) Subsidies is a part of government expenditure which is constrained by government's budget. Feasibility of subsidy in the long run therefore depends on whether government has the ability to finance the expenditure. <u>Current systemic constraints</u> (-) Subsidies may also be less feasible for countries where government accounting systems are not well-established. In such cases, subsidies may not reach all intended recipients.
Unintended Consequences	<u>Impact on future generations</u> (-) To continue financing subsidies, governments may have to raise taxes or borrow which incurs debt. These have implications on the welfare of the current and future generation of people (e.g. Government raise tax to reduce debt levels). <u>Equity Issues</u> (-) If government takes a "blanket" approach (i.e. same amount of subsidies are given across the board), it may lead to equity issues, as consumers/producers who are more in need of subsidies, may not necessary receive more support. Due to imperfect information, governments in fact may have difficulty identifying the correct group of consumers/ producers who are most in need of the subsidies.
Extent of Appropriateness	• Appropriateness depends on the Effectiveness + Feasibility – Unintended Consequences of the policy.

(b) Direct /Joint Provision

Refer to Section F, Activity sheet 1

<u>Explanation of policy (Direct provision)</u>

With direct provision, the government takes over the role of the producer in making production decisions such as how much to produce, the quality of the goods and service and how much to charge. In the real world, the government may contract the actual supply of the service to private firms.

The government may choose to make the service free for consumers at the point of consumption, as is the case with the National Health System (NHS) in the UK; or charge a small proportion of the actual cost of supplying the good, as is the case with education in Singapore.

<u>Explanation of policy (Joint provision)</u>

Joint provision is the case where the public and private sector jointly provides for the market. That is where the private sector provides the market equilibrium quantity while the government supplies the quantity difference between market equilibrium and social equilibrium. Examples of such joint provision are the presence of private and public schools and hospitals.

- The coexistence of private and public services offers greater variety for consumers to choose from, hence raising satisfaction level.
- Competition between the public and private sectors will also improve the quality of the service through contract bidding. This raises the satisfaction level further.

Activity: Please complete the following table (Self-work)

Note: The government's factors of consideration for Direct / Joint provision of good with externality are like similar to those taught under Direct provision of public good.

Can you remember what are the factors and how does it affect the effectiveness and feasibility of joint provision of goods with positive externality? You can consider using the example for joint provision of pre-school education service in Singapore.

Government's Factors of Consideration

EXTENT OF EFFECTIVENESS Can consider: Opportunity cost Government's information failure:	
DEGREE OF FEASIBLILITY: Constraints (Whether the policy is doable/viable in terms of (1) resources, (2) financial budget and (3) knowledge and technical capability)	

c) Legislation / Rules and Regulation

Refer to Section G, Activity sheet 1

- Legislation / rules and regulation are targeted at increasing consumption of goods/services that generate positive externalities to socially optimal levels through enacting laws.
- When they are not adhered to, penalties such as fines may be imposed.

Examples

The Compulsory Education Act in Singapore requires all parents of kids between the age of 6 and 15 to send their children to primary and secondary schools. This ensures that parents who are not fully aware of the importance of basic education for their children do not deprive their children of it. There are also large external benefits to society from individuals consuming basic education such as their participation in a productive workforce.

Explanation of policy (with using the example)

- The government may impose mandatory production or consumption of a good / service, such as the "Compulsory Education Act". Consumers (parents) will face a penalty if they fail to send their children for primary and secondary education, hence the consumers (parents) will be forced to send their children to schools, thus causing the demand for education to increase.
- **Since the consumer's demand is reflective of the consumer's marginal private benefit**, this will also mean that MPB will increase and in turn the MPB curve to shift to the right to the MSB curve (as seen in figure 6, where MPB shift to MSB = MPB') .
- Hence the quantity will increase to the socially optimal level.

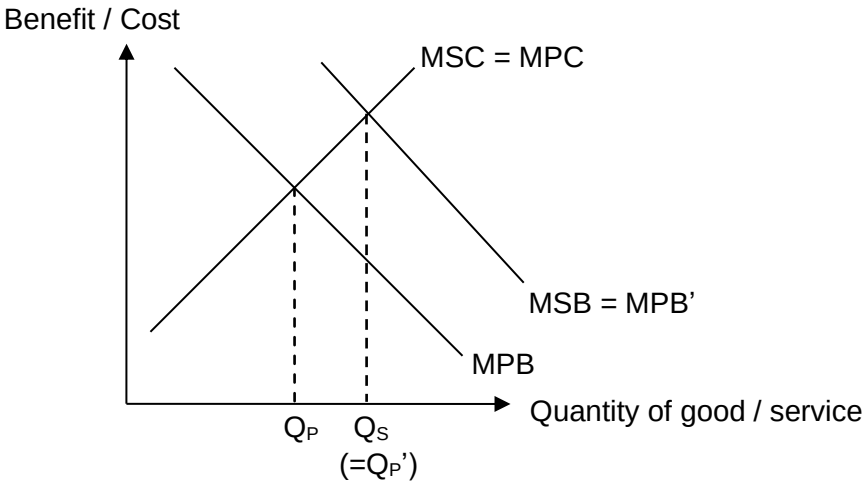


Figure 6: Effect of Mandatory/Compulsory Legislation

Government's Factors of Consideration

Refer to Section G, Activity sheet 1

EXTENT OF EFFECTIVENESS	Possible loopholes: (-) Can be difficult for governments or regulatory bodies to specify all the rules. Therefore, firms and consumers may seek to exploit loopholes in the regulations, which may render the policy ineffective. Severity of penalties: (-) The effectiveness of any legislation also depends on the harshness of the penalties imposed. The penalties for non-compliance must be sufficiently harsh to enhance the effectiveness of any legislation. Cognitive bias (**Loss Aversion**): (+) Mandatory legislation can be effective especially when it represents a loss to economic agents. Economic agents are subjected to cognitive bias of loss aversion as they weigh losses disproportionately higher than gains. This may result in economic agents having a greater responsiveness to penalty than other policy like subsidy. For example, in the case of compulsory education to increase intake for basic education. It may be more effective to make it mandatory and place a penalty for non-compliance than to subsidise education services.
DEGREE OF FEASIBLILITY: Constraints (Whether the policy is doable/viable in terms of (1) resources, (2) financial budget and (3) knowledge and technical capability)	Financial Constraint: (+) Monitoring costs will be incurred as inspectors and police must be deployed to conduct checks to ensure that the legislation is being obeyed. However, the addition cost incurred for hiring additional manpower to monitor and enforce are usually lesser than other policies like subsidy or provision of good. Hence it creates lesser financial strain on the government and makes the legislation policy more feasible for the government to continue implementation of the policy in the long-run. Current systemic constraints: (-) In addition, the feasibility of implementing this policy also depends on whether the country has good systems (e.g. national registrar) and law enforcement institutions as government needs to enforce regulations. In countries where these are lacking, for e.g. where law enforcement officials are corrupt, legislation will not be well enforced as a result. Some factors that may affect the strength of enforcement in a country can be: 1) Level of corruption 2) Size of country (accessibility to rural area) 3) Ability to leverage on information technology for tracking etc

Optional pre-tutorial question in SLS Section G, activity sheet 2
(Question: Legislation in the Singapore Vaccine Market)
(Use writing paper to do this optional question)

3.2.1.5 Practice Questions on Policy Intervention (Positive Externality)

Q1) Adapted from 2019 RI H1 Promo P1Q1)

Extract 1: Singaporeans to benefit from subsidised health screening
In a move to detect medical problems early and prevent bills from spiralling out of control later, the Singapore Government is launching a highly subsidised national health screening programme for up to five common conditions. This is aimed at raising the awareness of Singaporeans to the benefits of early detection and intervention of many diseases which raises the chances of successful treatment greatly. In addition, health screening reduces the burden of financial cost and care on patients' relatives. It would also reduce healthcare expenditure of the government which is financed mostly from taxes.

Source: Adapted Straits Times, 10 Mar 2017

(a) With the aid of a diagram, explain how subsidies can address the market failure in the health screening market. [6]
(b) Evaluate the appropriateness of subsidy in address the market failure in the health-screening [8]

Q2) Adapted from 2017 RVHS H1 Prelim P1Q1

Extract 1: Singapore's healthcare success did not come cheap or easy

Singapore's success in providing affordable and accessible acute healthcare is a result of strong controls, argues one expert. The issue of healthcare reform has become ever more contentious, as governments look to curb spending and limit their fiscal responsibilities. In the face of anxieties over rising healthcare costs, Singapore's healthcare model has caught the world's eye, especially its medical savings account scheme, Medisave. Observers see it as a clever mechanism for reducing the fiscal obligations of the government while building households' capacity to pay for their own healthcare needs. Singapore's healthcare system is not without its challenges. Though Singapore has managed to maintain modest overall spending, it has a rapidly ageing population and most healthcare expenditures continue to be financed out-of-pocket. Then for outpatient services, poorer and older Singaporeans are finding it increasingly unaffordable and inaccessible.

(a) There tends to be under-consumption in the healthcare market. Explain how the legislation of a medical saving account scheme having is able to encourage the consumption of healthcare service. [4]

(b) Explain two reasons why the medical saving account scheme described above may not be sufficient to tackle this under-consumption. [6]

3.2.2 Negative Externalities

In the case of goods with negative externalities, it is possible that both consumption and production of such goods/service may have spillover over costs on third parties.

definition

Negative externalities can be defined as **third-party costs** resulting from the consumption / production of a good / service. The existence of negative externalities in consumption / production results in a *divergence* between private cost and social cost at all levels of outputs.

MSC = MPC + MEC (Marginal External Cost)

If there is existence of MEC, then, MEC > 0, making MSC > MPC

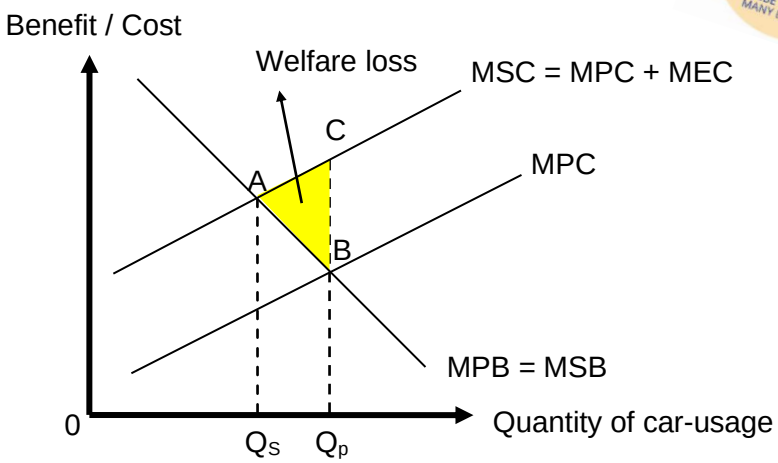
The existence of external costs results in **social costs associated with consuming / producing a good being greater than its private costs**.

3.2.2.1 Negative Externalities in Consumption

Refer to Section H, Activity sheet 2

Negative externalities in consumption can be defined as third-party costs resulting from the consumption of a good / service.

An example is the usage of private vehicles, i.e. cars.

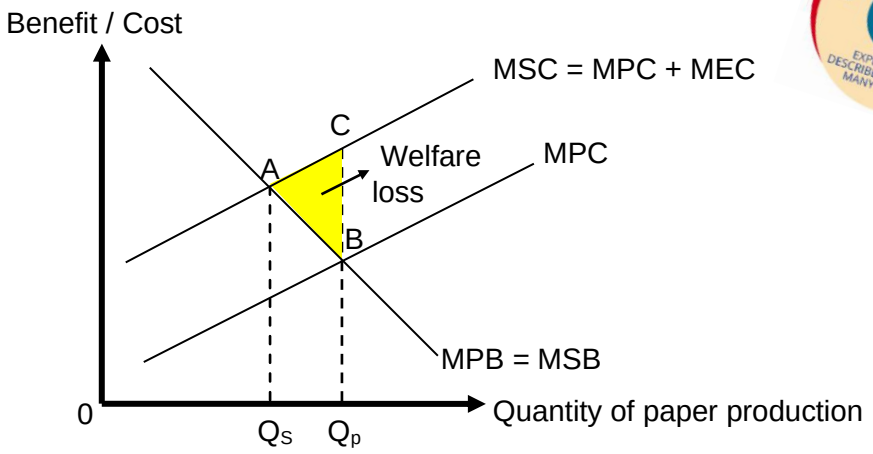
How Negative Externalities in Consumption Lead to Market Failure	
Diagram	 **Figure 7: Presence of negative externalities causing market failure**
Step 1 Private optimal equilibrium where MPC = MPB	The marginal private benefit (MPB) to the owner of a private vehicle could include convenience, personal comfort, reputation etc., while his marginal private costs (MPC) include petrol costs, maintenance costs etc.

	In a free market, without government intervention, the consumer of the private vehicle maximises his/her own welfare by consuming at $0Q_P$ where MPB = MPC and this is the private optimum output.
Step 2 Identify the cause of market failure *(i.e. identify the consumers, producers, third party involved and the external effects.)* Using the diagram, explain effect of negative externalities on MPC and MSC	Assuming that there are no positive externalities, MPB equals to marginal social benefit (MSB). The usage of private cars however generates negative externalities in consumption. Traffic congestion, as a result of the usage of private cars, might cause other users of public roads to experience longer travel times and delays. This may mean loss of income for some workers such as hourly-rated workers. The economy as a whole, which could also be regarded as a third party, experiences a loss of productive man-hours and output. With the presence of MEC, there is a divergence between the marginal social cost (MSC) and MPC, where MSC is higher than MPC. This is illustrated in Figure 7 where the MSC lies above the MPC, with the vertical distance between MPC and MSC representing the MEC.
Step 3 Identify MSC & MSB at output 0Qp to identify that there is over consumption.	At $0Q_P$, MSC > MSB. As such, at the private optimal level of output $0Q_p$, society values an additional unit of private vehicle consumed (i.e. MSB) less than what it would cost society (i.e. MSC). **As such, less of private cars should be consumed to increase social welfare.**
Step 4 Social optimal equilibrium where MSC = MSB	The socially optimal output is at $0Q_s$ where MSC = MSB. Hence, when left to the market forces, there is an over-consumption of private vehicle by Q_PQ_S.
Step 5 Identify the welfare loss area on the diagram and link back to the question	By summing the excess of MSC over MSB for the units Q_sQ_p, we arrive at a monetary measure of welfare loss (also known as deadweight loss) of area ABC to the society.
Step 6 Answer the question	As a result, the overconsumption of private cars leads to market failure and may require government's intervention.

3.2.2.2 Negative Externalities in Production

Refer to Section H, Activity sheet 2

Negative externalities in production can be defined as third-party costs resulting from the production of a good / service.

How negative externalities in production lead to market failure	
Diagram	 © **Figure 8: Negative externalities resulting in market failure**
Step 1 Private optimal equilibrium where MPC = MPB	In the process of producing paper, firms usually engage in slash and burn method to clear land. The marginal private benefit (MPB) to the firm that uses slash-and burn method could include the ease and convenience of using this method, saving on costs, while the marginal private costs (MPC) could include the labour and equipment costs. In a free market, without government intervention, the producer maximises his/her own welfare at $0Q_P$ amount where MPB=MPC. Therefore, the private optimum output for him/her is at $0Q_P$.
Step 2 Identify the cause of market failure *(i.e. identify the consumers, producers, third party involved and the external effects.)* Using the diagram, explain effect of negative externalities on MPC and MSC	Assuming that there are no positive externalities, MPB equals to marginal social benefit (MSB). In the process of producing paper, the usage of the slash-and-burn method however generates negative externalities in production. Third parties such as the villagers in the area who are not directly involved in the production or consumption of paper could suffer from external costs such as medical costs because they need to be treated for breathing difficulties, for which they receive no compensation from the firm. With the presence of MEC, there is a divergence between the marginal social cost (MSC) and MPC, where MSC is higher than MPC. This is illustrated in Figure 8 where the MSC lies above the MPC, with the vertical distance between MPC and MSC representing the MEC.

Step 3 Identify MSC & MSB at output 0Qp to identify that there is over consumption.	At $0Q_P$, MSC > MSB. This means that at output $0Q_P$, it costs the society more to produce an additional unit of paper using the slash-and-burn method than what the society can benefit from. Society desires less paper produced using slash-and-burn method. There is an over-allocation of resources to the production of paper using this method.
Step 4 Social optimal equilibrium where MSC = MSB	Hence, when left to the market forces, there is an over-production of paper using slash-and-burn method by Q_sQ_p amount since the private optimal output is at $0Q_P$, where MPC = MPB, is more than the socially optimal output, 0Qs where MSC = MSB.
Step 5 Identify the welfare loss area on the diagram and link back to the question	By summing the excess of MSC over MSB for the units Q_sQ_p, we arrive at a monetary measure of welfare loss (also known as deadweight loss) of area ABC to the society.
Step 6 Answer the question	As a result, the over-production of paper, that uses the slash-and-burn method, will lead to market failure and may require government's intervention.

3.2.2.3. Practice Question on Negative Externalities (Causes & Consequences)

Q1) Adapted from 2017 SAJC H1 Prelim P1Q1

Extract 1: Environmental Impacts Associated with Major Food Crops

In countries like India, agricultural intensification (involving the adoption of modern irrigation, fertilizers, improved seeds, and pesticides) has contributed to dramatic gains in food yields since the 1960s. However, increasing evidence suggests that intensive farming systems, if not properly managed, can cause serious environmental harm by reducing soil fertility, polluting soil and water, depleting groundwater, using large amounts of fossil fuels for water pumping, and contributing to climate change.

(a) Explain the negative externality that arise from the agriculture industry. [2]
(b) Explain how the negative externality causes market failure in the agriculture industry. [4]

3.2.2.4 Policy Intervention for Goods with Negative Externalities

	Policies to correct market failure to the presence of negative externality
(a)	Indirect Taxes
(b)	Legislation / Rules and Regulation
(c)	Tradeable Permits

a) Indirect Taxes

Refer to Section I, Activity sheet 1

Indirect taxation is a tax imposed on producers for the production and sale of the good /service.

Explanation of policy

With reference to Figure 9, by imposing a per-unit tax that is equal to MEC at $0Q_S$,

- The tax has the same effect as increasing the marginal private cost of production or consumption.
- Thus, the tax shifts the respective agent's MPC vertically upwards by the full amount of MEC to coincide with MSC. This is illustrated by MPC + tax.
- The new private optimal output level where MPC' equates to MPB is now at $0Q_P$', which coincides with $0Q_S$.
- This means that producers or consumers will now decrease production or consumption to the socially optimal level $0Q_S$. Thus, allocative efficiency is attained.

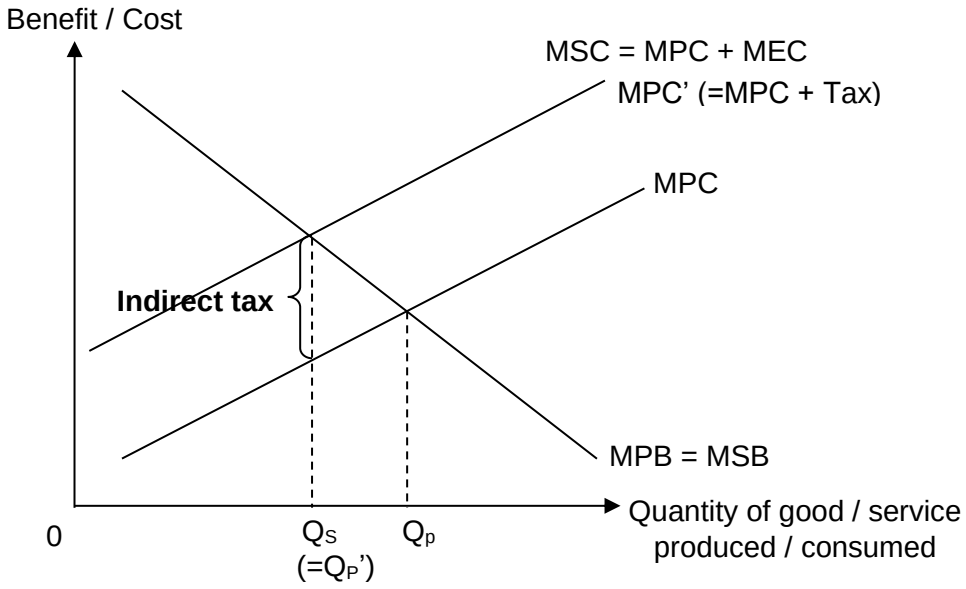


Figure 9: How indirect taxes correct market failure

Government's Factors of Consideration

Refer to Section I, Activity sheet 1

EXTENT OF EFFECTIVENESS	Flexibility of the adjustment of the policy (+) There is flexibility in the policy as the government could decide on the amount of tax to be given to different groups of people and/or when the tax is given etc. And it is relatively easy to adjust amount/when/how the tax is given. (Amount of tax can be adjusted to reflect changes in estimations of the MEC, e.g. different vehicle tax levied on different vehicle types, based on emissions produced). This adds to the effectiveness of this policy to achieve social optimal level of output by levying an accurate amount equal to MEC. Government's imperfect information (-) However, under conditions of imperfect information in the real world, it may not be easy to estimate the value of MEC accurately. Under-valuation of MEC leads to a reduction in output that is not sufficient to bring output to the socially optimal level. An over-valuation of MEC leads to output falling below socially optimal level. In both cases, society's welfare is reduced and not maximised. Responsiveness of economic agent: PED (-) In the case of negative externalities in consumption, if the demand for the good is price inelastic, the tax imposed must be sufficiently high enough to achieve the desired fall in consumption to the socially optimal level. Possible loopholes (-) Can be difficult for governments or regulatory bodies to specify all the rules. Therefore, firms and consumers may seek to exploit loopholes in the regulations, which may render the policy ineffective. For example, firms would find ways to pay less taxes such as tinkering with monitoring devices, which may render this policy less effective in reducing production to the social optimal level. Cognitive Bias: Loss Aversion (+) Tax can be effective especially when it represents a loss to economic agents. Economic agents are subjected to cognitive bias of loss aversion as they weigh losses disproportionately higher than gains. This may result in economic agents having a greater responsiveness to taxes than other tools. For example, in the case of taxation to reduce ownership of more pollutive cars. It may be more effective to tax the ownership of pollutive cars than to subsidise alternatives such as electric vehicles since there will be a tangible loss to owners of pollutive cars.

	<u>Cognitive Bias: Sunk Cost Fallacy</u> (-) High Certificate of Entitlement (COE) prices and car taxes substantially raise the costs of owning a car in Singapore. To better spread the high fixed costs of owning a car, drivers in Singapore tend to utilise their cars more often. This makes drivers less responsive to a rise in Electronic Road Pricing (ERP) rates and reduces the effectiveness of road pricing as a measure to control road usage and hence traffic congestion.
EXTENT OF FEASIBILITY	<u>Political Constraints:</u> (-) Political constraints may also occur in countries where pollutive industries dominated by a few large firms have strong lobbying power and close ties to government. Firms may threaten to move activities to other countries without such taxes, resulting in the loss of jobs and support for government.
UNINTENDED CONSEQUENCE	<u>Potential benefits from tax revenue collected</u> (+) Tax revenue collected could be used to fund research efforts targeted at lowering MEC of the activity, thus reducing MEC in the long term, or fund clean-up projects from environmental damage in the past, e.g. beautifying mined areas, reforestation projects, or for other broader purposes unrelated to this market. <u>Potential costs from tax implementation</u> (-) In the case of taxing goods / services whose demand is price inelastic. For instance, tobacco or alcohol (in some societies), the need to tax the good very heavily results in a large rise in price and fall in quantity sold to socially optimal level means that the policy would be politically unpopular and a government implementing the tax would lose votes. (especially in societies where a large proportion of the population consumes such goods). Hence, the government may not be able to implement taxes in fear of such unintended consequences.

b) Legislation / Rules and regulations

Governments may impose legislations / rules and regulations (backed by fines or other forms of punishments) in order to influence firms' or consumers' behaviour. These measures compel firms and consumers to moderate their actions as a result.

<u>Explanation of policy</u>

Regulation can affect the quantity of good / service produced / consumed directly or indirectly:

1) <u>Regulation of production / consumption quantity</u>

Refer to Section J, Activity sheet 1

Regulation can be imposed on producers and consumers to limit the amount of good / service produced / consumed. If regulation is set at socially optimal output $0Q_S$, then allocative efficiency will be attained.

Regulations of quantity are also known as quotas. A production quota limits the amount of goods that the industry can legally produce / sell, while a consumption quota limits the amount of goods that consumers can consume / buy.

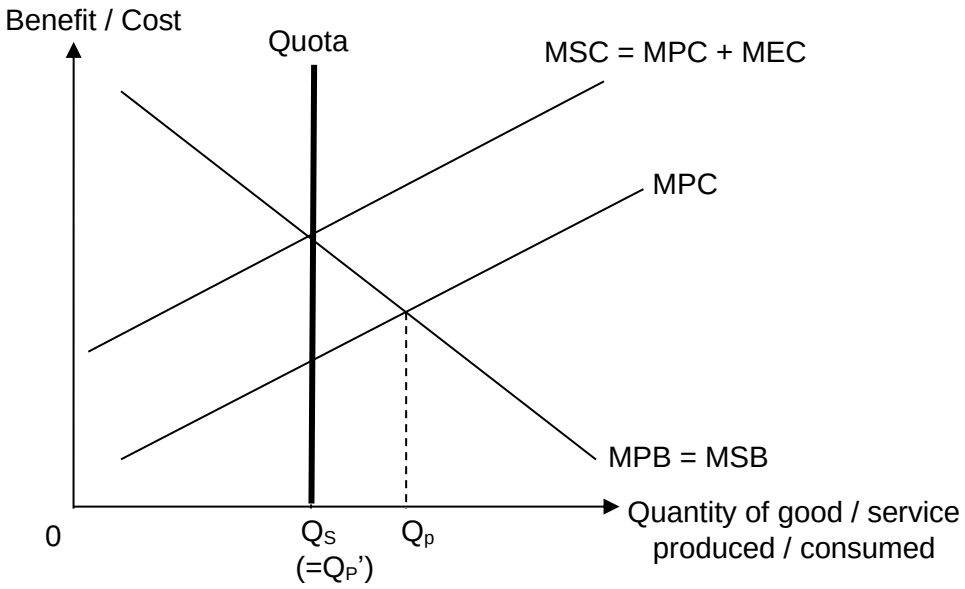


Figure 10: How quota correct market failure

The government can **impose a production quota equal to $0Q_S$ (the socially optimal level)**. With reference to Figure 10, if a production quota is imposed, firms would have no choice but to comply and limit the supply to $0Q_S$ instead of $0Q_P$. The deadweight loss resulting from over-production is thus eliminated. For example, China has set quota on rare earth production.

The government can also impose a consumption quota whereby the **consumers can only consume up to the quantity $0Q_S$.** In Singapore, the Certificate of Entitlement (COE) that a motorist needs to have is a consumption quota.

In some cases, where the external cost is regarded to be extremely high, a quota of zero (also called a ban) will be set. In such cases, the production or consumption of the good is illegal. Examples include ban on recreational drug use in Singapore, selling of chewing gums, and Indonesia's ban on slash and burn method of clearing forests.

The government then monitors if economic agents adhere to the quota and imposes penalties for non-compliance. Such penalties may include fines, or orders to cease production or consumption temporarily.

Examples

- Ban on consumption of recreational drug use in Singapore.
- Ban selling of chewing gums in Singapore to reduce consumption of chewing gums.

- Liquor Control (Supply and Consumption) Act[1] – drinking is banned in all public places and retail shops are also not allowed to sell takeaway alcohol from 10.30pm to 7am. Anyone drinking illegally can be fined up to $1,000 and repeat offenders may be fined up to $2,000 and jailed for up to three months. A shop selling alcohol after the permitted hours could be fined up to $10,000.

2) ***Regulation of production / consumption behaviour***

Refer to Section J, Activity sheet 2

i. Regulation that raises MPC:

Regulation can be imposed on producers. This will **impose costs on the affected firms as they need to invest in equipment to treat their emissions**, which are negative externalities in production. These firms are therefore internalising part of the external costs of their actions. This **increases producers' MPC** to match the MSC so that producers **internalise** the external cost and **reduce production** to the socially optimal output $0Q_S$**.**

Example:

- Regulation imposed by government to prohibit the use of harmful fertilisers to grow crops hence firms have to find alternatives that are organic or less harmful which can be more expensive or costly.
- Indonesia's ban on slash and burn method of clearing forests for production of goods hence firms must invest in machineries or cleaner methods of production.

Regulation can also be used to raise the MPC of consuming goods / services which generate negative externalities. For example, making smoking more restrictive for smokers will increase the inconvenience of smoking, so that **MPC increases** and the private optimal output **falls** to lower the extent of over-consumption**.**

ii. Regulation that lowers MEC:

Regulation can be imposed on producers to lower the external cost that is generated in the production of goods / services. This will lower the negative externalities in production and close the gap between $0Q_P$ and $0Q_S$.

Refer to Section J, Activity sheet 3

Government's Factors of Consideration

EXTENT OF EFFECTIVENESS	Degree of control by the government: (+) Quota directly forces consumers / producers to consume / produce at the socially optimal level of output, therefore directly reduces the level of MEC to the desirable level. Once the legislation is set, the government can continue to monitor the situation and make changes according to market conditions. More effective compared to taxation if demand for the product is price inelastic, as firms and consumers have to just adhere to the legislation. Possible loopholes: (-) Can be difficult for governments or regulatory bodies to specify all the rules. Therefore, firms and consumers may seek to exploit loopholes in the regulations, which may render the policy ineffective. Severity of penalties: (-) The effectiveness of any legislation also depends on the harshness of the penalties imposed. The penalties for non-compliance must be sufficiently harsh to enhance the effectiveness of any legislation.

EXTENT OF FEASIBILITY	<u>Manpower Constraint:</u> (-) While costs of monitoring can be recovered by fines imposed for non-compliance, governments have limited manpower resources to set up strong regulatory body to ensure that producers and consumers comply. Hence, governments may channel valuable resources from other important sectors (such as education or military defence) towards monitoring and enforcement which results in higher opportunity costs. <u>Current systemic constraints:</u> (-) In addition, the feasibility also depends on whether the country has good systems (e.g. national registrar) and law enforcement institutions as government needs to enforce regulations. In countries where these are lacking, for e.g. where law enforcement officials are corrupt, legislation will not be well enforced as a result. Some factors that may affect the strength of enforcement in a country can be: 1) Level of corruption 2) Size of country (accessibility to rural area) 3) Ability to leverage on information technology for tracking etc
UNINTENDED CONSEQUCE:	<u>Trade-off to other government's objective:</u> (-) Implementation of quota that result in firms' loss of market autonomy and profit due to the lower production level will encourage firms to relocate their factories to countries without such restriction. This will in turn results in job loss and lower economic growth

Optional pre-tutorial question in SLS Section J, activity sheet 4 (Question: Legislation in Singapore Car Market) *(Use writing paper)*

c) Tradeable permits

(Only applicable for negative externalities in production)

Refer to Section K, Activity sheet 1

A policy that has grown popular in recent years is that of tradeable permits, also known as 'cap-and-trade' system.

Explanation of policy

- Government first sets a limit on the amount of pollutants which can discharged which will correspond to a number of pollution permits to be given out to firms. **A permit gives a polluter the right to discharge pollutants of a certain amount (e.g. 100 units of carbon dioxide a year) into the environment.** If the total number of permits issued (and hence amount of pollutants) corresponds to the socially optimum quantity, it will address the market failure problem.
- More importantly, the permits that the firms received from the government can be resold in the trading market. Firms internalise the external cost as they pay the price of pollution permits which **is determined by the market demand for permits by firms wanting to pollute, and the market supply of permits by firms who has excess permits to sell.**
- This will increase the firms' MPC and move it closer to the MSC. Hence making the private optimal output closer to the socially optimal level of output.
- Firms who could reduce pollution cheaply by changing production processes and investments in green technology would do so as long as it is cheaper than to buy a permit at the prevailing market price. They would then either not require additional permits, and / or be able to sell the permit off in the market to another firm who is not able to reduce pollution cheaply.

Government's Factors of Consideration

Refer to Section K, Activity sheet 1

EXTENT OF EFFECTIVENESS	Government's imperfect information: (-) As the impact of the pollution is accumulative and difficult to measure, hence it is difficult for the government to correctly and accurately identify the optimal level of emissions and therefore decide on the correct number of permits to be issued so as to achieve the socially optimal level of output, thus limiting the effectiveness of the policy. Market autonomy: (+) Allowing permits to be traded effectively creates a market for pollution, and allows it to be reduced in an efficient way since **firms will decide whether to pay for the permit or invest in cleaner technology to reduce pollution**. That is, the highly pollutive firms with **high clean up cost** will have to pay for more limited amount of permits, which cost more. Less pollutive firms which has comparatively lower clean-up cost, in turn would reduce their emissions, and sell off excess permits. This ultimately is effective as it allows firms to reduce emissions at the lowest costs (price of permits vs. cleaning up cost.)

	Severity of penalty: (-) The effectiveness also depends on the level of monitoring and harshness of the penalties imposed should firms pollute beyond their given permit quota. The penalties for non-compliance must be sufficiently harsh to enhance the effectiveness this policy.
EXTENT OF FEASIBILITY	Financial constraint: (+) Once implemented, firms trade for permits amongst themselves with little cost to the government. Hence it is less financially taxing on the government and is more feasible for governments to continue the implementation of the policy in the long run. Current systemic constraints: (-) In addition, the feasibility also depends on whether the country has good systems (e.g. national registrar) and law enforcement institutions as government needs to enforce regulations. In countries where these are lacking, for e.g. where law enforcement officials are corrupt, legislation will not be well enforced as a result. Some factors that may affect the strength of enforcement in a country can be: 1) Level of corruption 2) Size of country (accessibility to rural area) 3) Ability to leverage on information technology for tracking etc
UNINTENDED CONSEQUENCES	Trade-off to other government's objective: (-) Due to the imperfect information, government may issue insufficient permit to each individual firms, thus resulting in many firms needing to buy extra permits from the resale market. This in turn increases the firms' cost of production and lower their profit, hence some firms may choose to relocate to other countries or force to cut down production. This will then result in job loss and slower economic growth.

3.2.2.5 Practice Questions on Policy Intervention (Negative Externalities)

Q1) Adapted from 2017 JJC H1 Prelim P1Q1

Extract 1: Pollution in Bangladesh, told in colours and smell

Here in Savar, an industrial suburb of Dhaka, some factories treat their wastewater but many do not have treatment plants or chose not to operate them to save on utility costs. Few steps have been taken by the government to improve the environment issues and there is poor government regulation on proper waste disposal. “The garment industry is thriving on the under-pricing environmental externalities. There is a need to impose regulations on these factories to establish true price in the market.” said Rizwana Hasan, a prominent environmental lawyer.

(a) With use of a diagram, explain how imposing regulations like forcing factories to treat wastewater can reduce the misallocation of resources in the garment market [5]

Q2) Adapted from 2017 PJC H1 Prelim P1Q1

Extract 1: Is there an economic case for tackling climate change?

There are alternatives to curbing emission, notably emissions caps with tradable permits. The idea is that the curbs in emissions would be made by those businesses that could do it at the lowest cost. There have been experiments with this approach, notably in the European Union. If implemented effectively, the approach does have much in common with a carbon tax.

(a) Explain how tradable permit can help reduce the misallocation of resources. [4]

(b) Discuss whether tradable permit is more appropriate the carbon tax in curbing with the misallocation of resources cause by emission. [10]

4 INFORMATION FAILURE / IMPERFECT INFORMATION

In this section, we will study the market failure caused by imperfect information(Information failure).

As you might be aware by now, it is imperative that economic decision makers receive full and accurate information about market conditions. For e.g., consumers need information about the prices at which they can buy and the quality of the products for sale. Producers need to be able to observe how consumers react to prices. However in the real world, there is often **a great deal of ignorance and uncertainty due to imperfect information/ information failure** and this may not lead to intended consequences or may lead to unintended consequences.

definition

Information failure occurs when some, or all of the economic agents involved in transactions **do not have perfect knowledge** (full, accurate, relevant information) about the goods or service to correctly assess the true value of their marginal private cost and benefit.

Sources of imperfect Information

Refer to Section L, Activity sheet 2

From the video, what are the sources of imperfect information?

There are two broad cases of imperfect information / information failure, we will focus on under/overestimation of costs/benefits example below.

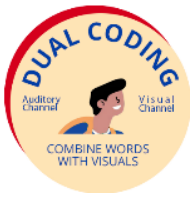
4.1 Under-estimation of Private Benefits

Refer to Section L, Activity sheet 3

Medical screening is an example where there is under-estimation of the private benefits (perceived benefits < actual benefits) thereby leading it to be under-consumed.

Imperfect information in this market arises because consumers are not **fully aware of the benefits** of regular medical screenings **to themselves,** which is the early detection of potentially chronic diseases such as cancer.

There is a higher likelihood of such diseases being effectively treated if discovered early. However, most consumers only get medically screened when serious symptoms are present. As such, consumers may under-estimate their actual marginal private benefit (MPB_{actual}) of going for medical screenings, resulting in a perceived marginal private benefit ($MPB_{perceived}$) that is lower than MPB_{actual}. (Illustrated in Figure 10).



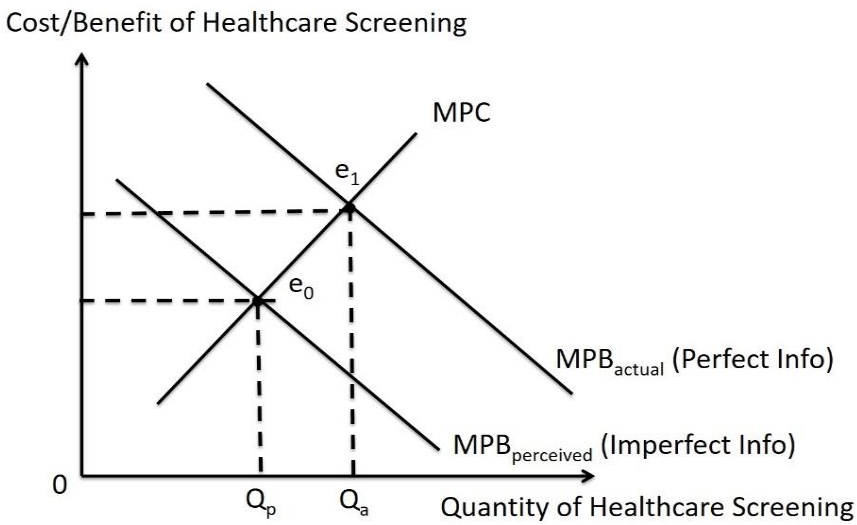


Figure 10: Market failure due to imperfect information

Using medical screening as an example, let us explain the market failure.

Explain the market failure in the market for medical screenings	
Step 1 Private optimal equilibrium where MPC = MPB	The perceived marginal private benefit ($MPB_{perceived}$) of a consumer in getting medical screening is the knowledge of his/her health status while his/her marginal private costs are the associated cost in getting the medical screening. In a free market, without government intervention, the consumer maximises his/her welfare by consuming the amount of medical screening $0Q_p$ where his/her **perceived** marginal private benefit ($MPB_{perceived}$) = marginal private costs (MPC). His/her perceived private optimal output is therefore $0Q_p$.
Step 2 Explain the cause of market failure using examples	The consumers are not fully aware of the benefits (to themselves) of regular medical screenings, which is the early detection of potentially chronic diseases such as cancer and cost savings from avoiding treatment of the illness for the long term (early treatment is more effective). In actual fact, most individuals only get medically screened when serious symptoms are present.

Step 3 Using the diagram, explain effect of imperfect information on $MPB_{perceived}$ and MPB_{actual}	Due to the imperfect information, consumers under-estimate their actual marginal private benefit (MPB_{actual}) of going for medical screenings. As the benefits of early medical screening is undervalued, the perceived marginal private benefit ($MPB_{perceived}$) is lower than their actual marginal private benefit (MPB_{actual}) as seen in the figure above. With perfect information, private optimum consumption should be at $0Q_a$ instead of $0Q_p$.
Step 4 Explain the outcome on the market	As a result, with the information gap, the consumer has underconsumed medical screenings. The quantity of medical screening consumed by the consumer is sub-optimal and does not maximises his/her welfare (i.e. Private optimality is not achieved). When all individuals under consume, the market will hence not be at the socially optimum level of consumption.

FYI

Medical screening is an example of a **merit good/service**, which are goods that government deems as socially desirable.

Merit goods typically exhibit two **distinct** characteristics:

- They have **positive externalities** when consumed.
- Consumers have **imperfect information** (i.e. consumers are unaware of the full benefits of the good to themselves) about these goods.

Food for thought: Are there goods that are deem undesirable by the government? Do you know what are they called? What are the distinct characteristics of these goods?

4.2 Under-estimation of Private Costs

Refer to Section L, Activity sheet 4

Smoking is an example where there is under-estimation of private costs (perceived costs < actual costs) thereby leading it to be over-consumed.

Imperfect information in this market arises because consumers are not **fully aware of the costs of smoking to themselves, which are the costs of buying cigarettes and the risk of developing chronic diseases such as lung cancer in the long term.** As such, when making a decision on whether to smoke and how much to smoke, the smoker would only consider short term costs like the monetary costs and health ailments such as sore throat.

As such, consumers may under-estimate their actual marginal private cost (MPB_{actual}) of smoking, resulting in a perceived marginal private cost ($MPC_{perceived}$) that is lower than MPC_{actual}. (Illustrated in Figure 13).

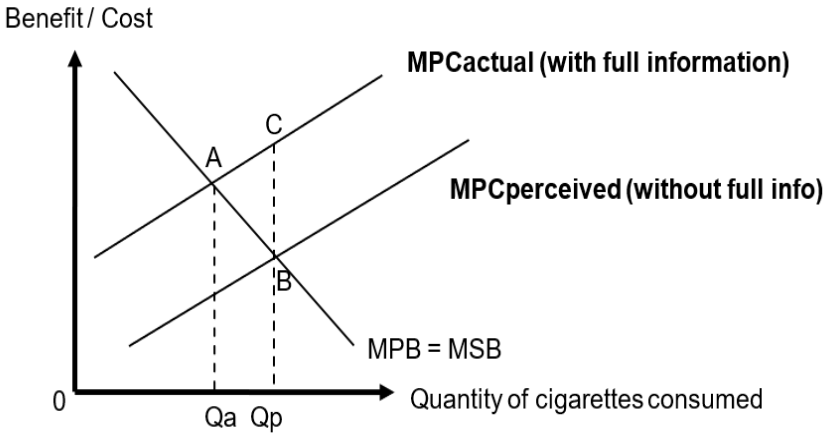


Figure 13: Market failure due to imperfect information

FYI

Imperfect information does not only result in underestimation of benefit/cost. There are situations where it might lead to overestimation of benefit/costs.

Like in the market of online gaming, consumers may overestimate their private benefit, perhaps due to their addiction to it. This leads to overconsumption and market failure.

Can you think of some cases whereby consumers might overestimate their private cost which result in them underconsumption of the good or service?

4.3 Policy Intervention for Imperfect Information

	Policies to correct market failure due to imperfect information
(a)	Provision of Information (To tackle the root cause of imperfect information)

However, it is also possible for the government to implement policies that target at resolving the problem of underconsumption or overconsumption without trying to resolve the root cause of imperfect information.

To tackle underconsumption refer to previous section 3.2.1.3:
- Subsidies, Legislation / Rules and Regulation, Direct/Joint Provision

To tackle overconsumption refer to previous section 3.2.2.3:
- Taxation, Legislation / Rules and Regulation

a) Provision of Information (public education in the form of campaigns and advertisements)

Refer to Section M, Activity sheet 1

Taking the above example market of medical screening, the health promotion board has carried out many public campaigns to encourage medical screening such as Breast Cancer Campaign to educate women about breast cancers and the benefit of mammogram screening for early detection.

Explanation of policy

Public education (campaigns and advertisements) is aimed at making consumers more aware of the full benefits of consuming a good / service to themselves (towards more informed decision-making).

- With public education, consumers perceive the benefits of the medical screening to be much higher.
- With reference to Figure 15, if such public education campaigns are successful, the private benefit for medical screening would increase from $MPB_{perceived}$ to MPB_{actual}. This, in turn, will cause consumption to increase from Q_p to Q_a, eliminating the extent of under-consumption due to imperfect information.

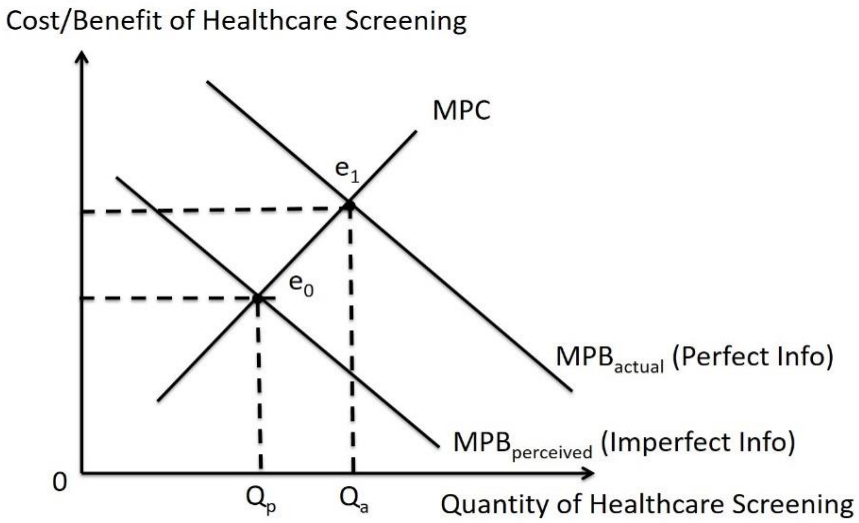
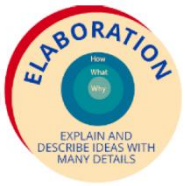


Figure 15: Public Education Campaigns to resolve underestimation of benefit

Public education (campaigns and advertisements) can also aimed at making consumers more aware of the full costs of consuming a good / service to themselves (towards more informed decision-making). To reduce the over-consumption of goods with underestimation of the private costs, the government should conduct public education on the ill-effects. By educating the public of the true costs of consuming such goods, the government aims to bridge the gap between the perceived private costs and the actual costs in consuming these goods.

Note: In some cases, government can appeal to consumers and producers morals, and encourage them to reduce the consumption these goods. It is referred to as **moral suasion**. This aims to persuade economic agents to change their consumption and production behaviours by taking into account third-party costs and benefits, even if rationally (in the pursuit of self-interests), these economic agents would not have.



Explanation of policy

Refer to Section M, Activity sheet 2

- Public education is implemented to increase the awareness of the ill effects of smoking cigarettes. Images of smoking-related diseases are printed on cigarette packets sold in Singapore, and there are many advertisements that showcase the health risks involved in consuming cigarettes to encourage people to quit smoking.

- The provision of such information will enable smokers to realise and be aware of the potential risk and costs of smoking (true costs of smoking), thus shifting $MPC_{perceived}$ leftwards to coincide with MPC_{actual}, as shown in Figure 15. This would reduce consumption of cigarettes from $Q_{perceived}$ to Q_{actual}.

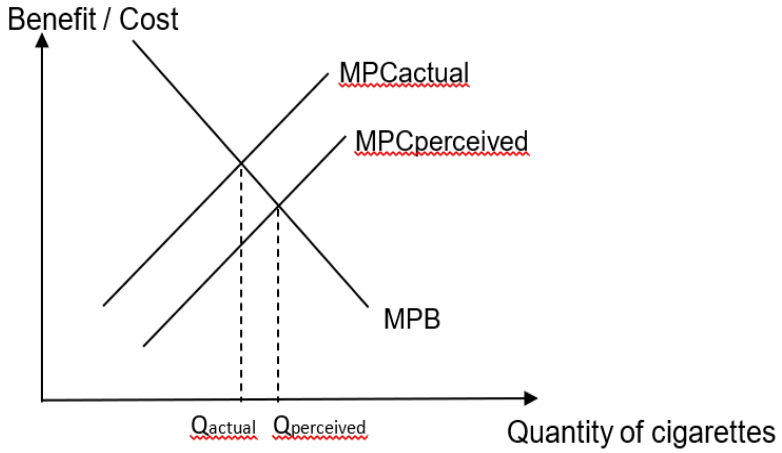


Figure 15: Public Education Campaigns to resolve underestimation of cost

Government's factors of consideration

Refer to Section M, Activity sheet 3

EXTENT OF EFFECTIVESS	Ability to solve the root cause of the problem (+) Directly addresses one root cause of problem – i.e. information failure *[achieves the intent]* Presence of cognitive bias (+) Consumers are subjected to cognitive bias such as saliency (Salience bias). For example, as obesity is a more visible problem as compared to other health issues like diabetes, public education campaigns aimed at reducing sugar consumption are likely to be more successful if they were to focus on how less sugar can help weight loss rather than how it can help prevent diabetes. Similarly, the Singapore government has made it mandatory for all tobacco products to have a standardized packaging and enlarged graphic health warnings to educate people on the harmful effects of smoking. The consistent and explicit exposure to the harmful health effect will create a strong reminder to the consumers of the harmful effect thereby encouraging smokers to quit and discourage non-smokers from picking up the habit. This can be effective in reducing smoking. Recency of the information (-) Dependent on how regularly the information is updated to reflect its accuracy and whether it reaches the intended audience. Provision of

EXTENT OF EFFECTIVESS	information to tackle the problem of underestimation of benefits is only effective if the information can be updated regularly to ensure accuracy. Channels to relay information also have to reach the intended audience. If not, provision of information ultimately would not be able to address the information gap. E.g. In large countries, citizens in the rural areas may not be able to receive information / be educated to change their consumption decisions. In Singapore, to reach out to the older generation the use of dialects and mother tongues would be essential to ensure the outreach of the policies, which may affect how quickly information is passed on. <u>Public opinion of the policy</u> (-) Dependent on the receptiveness of the public towards this policy. If individuals are not receptive to the campaigns, it reduces the effectiveness of the policy, i.e. the older population may be less receptive to public campaigns. For example, elderly may be less receptive to the campaigns about the benefit of the medical screening as they might have a stronger belief in traditional medicine and remedies to be the better way for prevention than medical screening. <u>Short vs long term impact of the policy</u> (-) Usually the effectiveness of the policy would only be felt in the **<u>long-run,</u>** as consumption habits, behaviour and mind-set of people take time to change.
EXTENT OF FEASIBILITY	<u>Financial constraint</u> (-) Dependent on the financial constraints of the government. Public education campaigns can be costly. It imposes a burden on the government's budget. If unsuccessful, it will drain the government's budget in the long run. Thus, it can be a long term and costly process with uncertain outcomes. Therefore, countries facing budget problems may not be able to implement such campaigns, especially in the long-run. <u>Technological constraints</u> (+) Dependent on the technical means and resources to publish the information. Provision of information is feasible as the government has the technical means and resources to publish information through official public channels (media platforms).
UNINTENDED CONSEQUENCES	<u>Opportunity cost</u> (-) Since provision of information requires government spending, governments may channel valuable resources from other important sectors towards this policy which results in higher opportunity costs

	<u>Long term benefits</u> (+) If the campaigns are successful, it will reduce the government's burden in the long run as the government can reduce the subsidies for production and consumption of the goods.

If a question asks if a policy is appropriate, you should weigh the effectiveness and feasibility of the policy. A policy is considered appropriate only when it is effective, feasible and there are minimal unintended consequences.

4.4. Practice questions on Information Failure (Causes, Consequences & Policy)

Q1) Adapted from 2017 DHS H1 Prelim P1Q1

Extract 1: Growing importance of health in the economy

The World Bank reports that 50% of the economic growth differentials between developing and developed nations are attributed to poor health and low life expectancy. The healthier the citizens of a country, the more effective the workforce. Health presents a challenge for all nations; in a study by the Pew Research Centre, a median of 85% of respondents believe it is a problem in their country. Health care decisions are complex to individuals. Unable to predict their medical needs, individuals might not see the need for an annual health check even if it were free. They often choose to consume too little of health care early in life, and later in life they might wish they had consumed more.

(a) With the aid of a diagram, explain how the market for health care fails, when 'health care decisions are complex to individuals'. [6]

(b) Discuss whether 'providing health care services' or 'educational campaigns' is more effective in ensuring a more efficient allocation of resources in the market for health care. [10]

5 INADEQUACY OF RESOURCE ALLOCATION VIA PRICE MECHANISM

5.1 Inequitable Distribution of Economic Welfare

Refer to Section N, Activity sheet 1

'Unfair' distribution of welfare between groups of consumers

Consumer's ability to purchase goods and services depends on their income. As such, the higher income groups tend to be in a better position to influence the demand of a good and resource allocation due to their higher dollar vote.

For example, a country with a large percentage of population earning significantly higher incomes may be influenced to produce more luxury goods for the higher-income earners rather than basic necessities, which could be highly demanded by the lower-income group. In addition, if market prices are too high, poor people may not be allocated basic necessities through the price mechanism. The price mechanism may thus lead to an inequitable allocation of resources.

5.2 Policy Intervention to Improve Equity

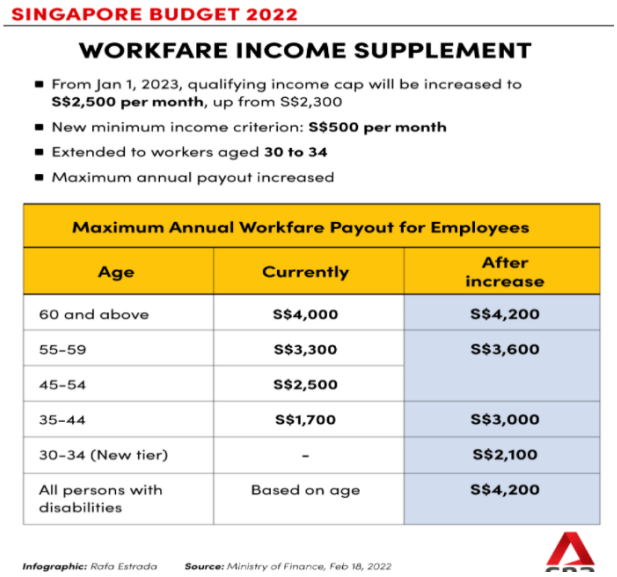
Refer to Section O, Activity sheet 1

The government can reduce the inequitable distribution of resources by reducing the unequal income distribution. There are some policies that the government can undertake to support the lower skilled workers so that more resources can be re-allocated to produce goods and services for them. They are:

	Policies to improve Equity
(1)	Subsidy
(2)	Direct Provision
(3)	Direct Taxation
(4)	Price Controls

1) Subsidies

Subsidies by the government to supplement the income and retirement savings of lower-income workers under the Workfare Income Supplement (WIS) scheme, through cash payments and CPF Contributions.



SINGAPORE BUDGET 2022

WORKFARE INCOME SUPPLEMENT

- From Jan 1, 2023, qualifying income cap will be increased to **S$2,500 per month**, up from S$2,300
- New minimum income criterion: **S$500 per month**
- Extended to workers aged **30 to 34**
- Maximum annual payout increased

Maximum Annual Workfare Payout for Employees		
Age	**Currently**	**After increase**
60 and above	**S$4,000**	**S$4,200**
55–59	**S$3,300**	**S$3,600**
45–54	**S$2,500**	
35–44	**S$1,700**	**S$3,000**
30–34 (New tier)	-	**S$2,100**
All persons with disabilities	Based on age	**S$4,200**

Infographic: Rafa Estrada *Source: Ministry of Finance, Feb 18, 2022*

Subsidies and cash awards are given when lower-income workers undergo training to up-skill and improve employability under the Workfare Training Support (WTS) scheme. Courses offered by Singapore Workforce Skills Qualification (WSQ) Approved Training Organisation (ATO) are of the long-term measures to narrow the unequal distribution of income between the low skilled and the high skilled workers.

- **Government funding** will **reduce cost of training for the low skilled workers or firms hiring low skilled workers**, hence making the **courses more affordable** for the workers and **increases the incentive** for firms to send their workers for skill upgrading.
- This will **improve and widen the workers' skillset**, which can **improve their employability.** With better skillsets, these workers can gain meaningful employment earn a higher income.
- This will **reduce the income inequality** and **increase the low skilled workers' ability to express their "dollar vote"**. As a result, their **effective demand** of goods and services that they want will **increase** (e.g. they will be able to gain access to more essential goods via the market) hence leading to a **more equitable allocation of resources**.

Take Note

Other examples of subsidy that can reduce inequity include subsidy for healthcare as mentioned in previous section on Policy Intervention for Goods with Positive Externality

<u>Government's factors of consideration</u>

EXTENT OF EFFECTIVESS	<u>Receptiveness of economic agents:</u> (-) Example: For the Workforce Training Support scheme, the workers may not be responsive to policy as such training scheme takes up a **substantial amount of time** and **may not be prompt in responding to the changing trends** in international labour market mobility. In addition, training does not necessary translate to application to their next job role. On the job training is still required. Hence, while subsidies increases their ability to get trained, it may not increase their willingness.
EXTENT OF FEASIBILITY	<u>Financial Constraints:</u> (-) Subsidies is a part of government expenditure which is constrained by government's budget. Feasibility of subsidy in the long run therefore depends on whether government has the ability to finance the expenditure.
UNINTENTED CONSEQUENCE	<u>Potential Economic Growth (Unintended benefit):</u> (+) When workers' skillset improved, the efficiency and productivity level of the labour force will increase, thus the quality of labour resources improved and with the same number of workers, more output can be produced. In addition, the workers also have a wider skillset that can better meet the various industrial demand for labour, this would **attract new and existing investment projects**. Hence, the economy's productive capacity will increase and the **production possibility curve shift outwards, boosting potential economic growth**

2) Direct Provision

The government can also choose to **directly provide** the goods / services in markets performing inequitably so that consumers have **equal access to these items, regardless of the differences in income**. This eliminates the consequence of inequitable allocation of resources into markets. *(Refer to Direct Provision in under section for "Public good")*

3) Direct Taxation (Progressive Taxation)

The unequal distribution of income can be addressed by imposing a direct tax[2] e.g. personal income tax (Table 3).

Income tax is an example under a progressive[3] tax system where **higher marginal tax rates are charged for higher amount of income earned**. Hence the high income earners will have to pay higher tax rates while low income earners[4] will pay low income tax rates. This will **reduce the higher income earners' disposable income more than that of the lower income earners**, therefore **reduce the higher income earners' ability to exercise their dollar vote**. This reduce inequitable resource allocation.

In addition, the **revenue collected** by the government can also be used to **provide the monetary benefits for low-income group** and reduce the inequitable distribution of resources between the high and low income earners.

Table 3: Income Tax Structure according to the Chargeable Income

From YA 2024 onwards

Chargeable Income	Income Tax Rate (%)	Gross Tax Payable ($)
First $20,000 Next $10,000	0 2	0 200
First $30,000 Next $10,000	- 3.50	200 350
First $40,000 Next $40,000	- 7	550 2,800
First $80,000 Next $40,000	- 11.5	3,350 4,600
First $120,000 Next $40,000	- 15	7,950 6,000
First $160,000 Next $40,000	- 18	13,950 7,200
First $200,000 Next $40,000	- 19	21,150 7,600
First $240,000 Next $40,000	- 19.5	28,750 7,800
First $280,000 Next $40,000	- 20	36,550 8,000
First $320,000 Next $180,000	- 22	44,550 39,600
First $500,000 Next $500,000	- 23	84,150 115,000
First $1,000,000 In excess of $1,000,000	- 24	199,150

Source: http://www.iras.gov.sg

[2] Direct taxes are levied directly on a person or institution receiving the income and paid directly by them to the Inland Revenue Authority of Singapore. The tax cannot be avoided or passed on to other people. Examples of direct taxes in Singapore are income tax or corporate tax.

[3] Progressive tax is a tax whose average rate with respect to income rises as income rises whereas Regressive tax is a tax whose average rate with respect to income falls as income rises.

[4] For those who earn less than $20,000 (after tax rebate) per annum, they do not need to pay any income tax.

Government's factors of consideration

EXTENT OF EFFECTIVESS	**Government's Imperfect Information:** (-) Governments may have **difficulties in setting the right level of tax** rate due to imperfect information. If the marginal tax rate is set too high, individuals will have less incentive to remain working the economy.
UNINTENTED CONSEQUENCE	**Reduced Potential Economic Growth:** A higher income tax may **result in brain drain** as higher income earners (usually higher skilled workers/ talent) will **start leaving the country in search of other countries that allow them to retain higher disposable income**. This will **reduce labour resource** in the economy and hence **reducing the potential economic growth.**

4) Price Controls[5]

Government can set price controls to ensure a more equitable distribution of resources. Price controls can be in the form of price ceiling and price floor.

Rental ceiling is an example of price ceiling. Berlin is the first German city to legislate rent-control to control rising rents[6] in the German capital. Landlords in Berlin are barred from increasing rents by more than 10% above the local average. This will **reduce the rent income for landlords**, hence **reducing the income inequality between the landlords and tenant**.

Minimum wage is an example of price floor. The national minimum wage in the UK will be raised by 20pence an hour to £6.70. This is to protect more than 1.4 million low-paid workers from the 3% rise. This would **ensure higher wages for this group of workers** and **reduce the wage differentials between them and high income groups**.

Government's factors of consideration

EXTENT OF EFFECTIVESS	**Ability to monitor and enforce:** Some landlords **may not truthfully declare** their intention to rent out their apartment, hence it is **difficult for government to monitor and enforce compliance** to the rental ceiling.
UNINTENTED CONSEQUENCE	**Price Ceiling (on essential goods like rice):** Need to implement complement policy: The obvious costs of price ceiling (i.e. queuing and black markets) often lead governments to **impose some form of rationing which comes at a cost.** The government must undertake the difficult job of adjusting rations to reflect fluctuating supplies and demands and the needs of individual consumers. **Price Ceiling (on rental):** Lower quality of goods/services (Unintended consequence): Rent ceiling may **affect landlords' profits**, hence **quality of rental apartments may fall** due to less need to renovate to attract new rental seekers. **Price Floor (Minimum wage):** Boost economic growth (unintended benefit): For minimum wage, it would **boost consumption and spending**. This would **raise economic growth**. Rise in average prices (Unintended consequence): Minimum wage will **increase the cost of labour** and hence **increase the cost of production**, hence **firms may cut back production**. This will result in **higher prices** (inflation). In addition, rising cost of production would also **reduce profit margins and investment projects and spending of firms**.

[5] refer to Notes on Application of DD/SS

[6] The difference between the rent paid in existing contracts and new contracts is currently high.

6 CONCLUSIONS

This set of notes has examined various contributing factors that lead to market failure and discussed their occurrence in isolation. However, it should be noted that in some instances, it is possible that more than one of these factors exist and hamper the efficient workings of the free market. Hence for the government to intervene in a market to correct the allocative inefficiency, it therefore is important that the contributory factors are correctly identified and dealt with appropriately.

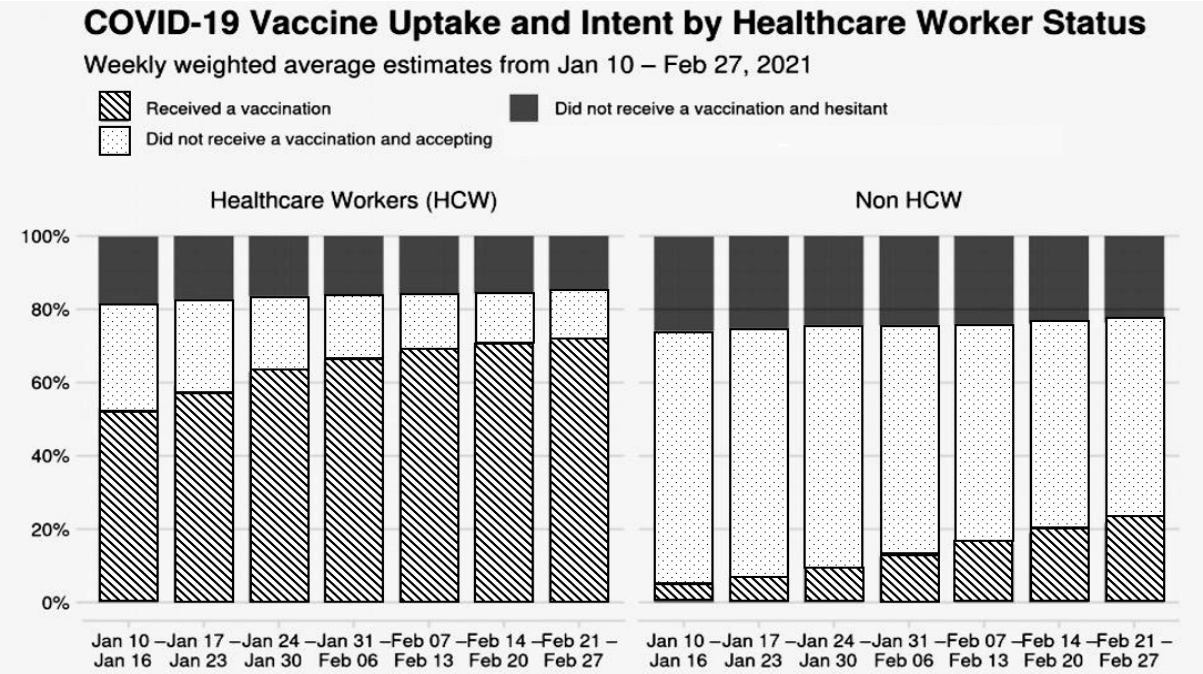
As the free market fails, the government may intervene by implementing various measures to correct the problem. However, the effectiveness of these measures may vary depending on the source of the problem as well as the presence of government failure.

7 PRACTICE QUESTIONS: FULL CASE STUDIES

Question 1: Adapted from 2021 CJC H1 Prelim P1Q1

Market for Vaccines

Figure 1: Vaccine Uptake and Intent by Healthcare Worker Status



Source: COVID-19 Symptom Survey Carnegie Mellon University, 12 March 2021

Extract 1: World's largest vaccine maker can't keep up with India's COVID wave

Earlier this year, countries around the world counted on the Serum Institute of India, which produces 60% of the world's vaccines each year, as a lifeline to supply them with COVID-19 jabs. Now, the Serum Institute is struggling to meet even the vaccine demands of its home country as India battles its worst-ever wave of COVID-19 infections. On Tuesday, India reported over 259,000 new cases of COVID-19, pushing total infections to 31.22 million and death toll to 418,480. In response, India's government is granting the Serum Institute $400 million in additional government funding to help it ramp up vaccine manufacturing capacity amid a countrywide vaccine shortage.

The government's financial support will give a much-needed jolt to the country's lagging vaccine campaign. However, it may do little to alleviate the vaccines shortage facing the country in the short term. Production has hit a bottleneck due to lack of critical raw materials like bags and filters.

Vaccine manufacturing processes are highly complex. In addition to managing international supply chains, effective manufacturing capacity expansion needs to overcome major challenges,

including but not limited to the need for highly specialised equipment, qualified and trained personnel and time-consuming technology transfers.
According to the World Trade Organisation (WTO), a typical vaccine manufacturing plant would use an estimated 9,000 different materials from 300 suppliers in 30 countries. Trade-related restrictions and outright ban on exports of raw materials by countries, such as the US, have made it impossible for vaccine makers to obtain raw materials. In addition, vaccine makers have pledged not to raise prices during pandemic, which may significantly delay the clearing of the vaccines shortage.

The pledge comes about because firms do not want to be seen to be profiting from the global crisis, especially after receiving so much outside funding from governments and donors. Indeed, the pledge has helped to prevent skyrocketing vaccine prices amid the unprecedented outbreak. The Serum Institute was selling Covishield to the federal government for 150 rupees ($2) per shot. Private hospitals are buying vaccine doses at prices set by each manufacturer-- 600 rupees per dose for Covishield, 1,200 rupees for Covaxin and 948 rupees for Sputnik V.

Source: Adapted from Fortune, 20 April 2021 and Nikkei Asia, 21 June 2021

Extract 2: Vaccine hesitancy a barrier to ending the COVID-19 pandemic

Countries around the world are rushing to get their citizens vaccinated and attain herd immunity – the point at which a critical mass of a population becomes immune to a disease-causing virus. Until then, economic activities will remain restricted, resulting in fewer goods and services being produced and slower or even negative economic growth. However, in March 2021, the discovery of the clotting issues paused the distribution of vaccines in countries around the world. Although health authorities later concluded that the benefits of these vaccines far exceed the risks and that distribution should resume, many became hesitant to get vaccinated. Reluctance is mainly driven by concerns about safety as well as a lack of information on the efficacy of vaccines.

Researchers found that adults who were unsure about receiving the COVID-19 vaccine and who were given more information about the vaccine's efficacy scored 20% higher on a measure of willingness to be vaccinated versus others who received no information. Further, receptivity improved and increased almost as double among survey respondents who were given information about how COVID-19 vaccines perform compared to the flu vaccine.

Source: Scientific American, 30 April 2021 and Pharmacy Times, 16 July 2021

Extract 3: Policies to encourage vaccination

In their race to drive up COVID-19 vaccination rates, governments around the world have deployed various strategies. India has adopted an open market policy where 28 state governments, as well as private hospitals jointly provide vaccination. Like other governments, the Indian federal government administers vaccines for free, but private hospitals which obtain vaccines at much higher prices, could charge market prices. On the other hand, states in the US are deploying various rewards to drive up coronavirus vaccination rates. Californians 12 years and older have a chance to win $50,000 if they complete their vaccination. Delaware residents between 12 to 17 years old will have a chance to win a full scholarship to a state university.

China could be nearing herd immunity from COVID-19 after administering jabs to 660 million of its population. Beijing's vaccination program is now inoculating people more than six times faster than the United States did at its mid-April peak. Public health campaigns fronted by celebrities have helped, as have incentives like cash handouts and free laundry detergent.

While some vaccinations such as those against COVID-19 may not be mandatory, some countries have passed laws that make certain childhood vaccinations mandatory for kids. For example, parents in Germany must vaccinate their children against measles or face substantial fines.

Source: Various

Questions

(a) With reference to Figure 1, compare the percentage of Healthcare Workers (HCW) who did not receive a vaccination and hesitant with that of Non Healthcare Workers (Non HCW) over the period given. [2]

(b) With reference to Extract 2 and using the Production Possibility Curve, explain how the COVID-19 pandemic might impact economic growth both in the short run and long run. [4]

(c) Extract 1 mentions that vaccine makers have pledged not to raise prices during pandemic and that this pledge prevented vaccine prices from skyrocketing amid the unprecedented outbreak.

(i) Using supply and demand analysis, explain how the non-profit pledge may "significantly delay the clearing of vaccines shortage" and comment on whether the shortage is likely to persist. [6]

(ii) Using the concept of price elasticity of supply (PES) and a diagram, explain why prices of vaccines could "skyrocket" amid the unprecedented outbreak of infections in India. [4]

(d) Extract 1 mentions that India's government is granting the Serum Institute $400 million to help it ramp up vaccine manufacturing capacity.

(i) Using the marginalist principle, explain how governments decide on the amount of subsidies to provide. [2]

(ii) Given the relationship that exists between price elasticity of demand (PED) and total revenue, explain how the government grant will increase total revenue of the Serum Institute. [4]

(e) Discuss the extent to which positive externality is the main reason for governments to intervene in the market for vaccines. [8]

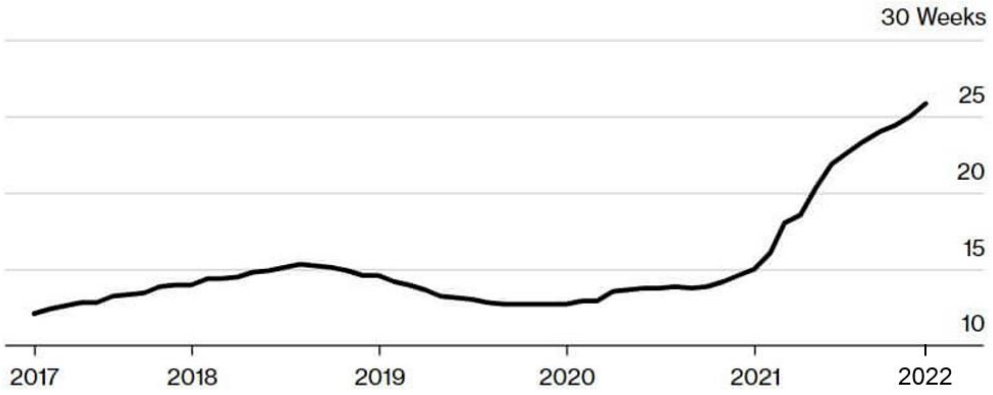
(f) Using the data provided and/or your own knowledge, evaluate whether joint provision is the most appropriate policy for various governments to achieve a more efficient allocation of resources in the market for vaccines. [10]

[Total: 40]

Question 2: 2022 NJC H1 Promo Q1

Worldwide semiconductor industry

Figure 1: Lead time[1] for semiconductor



Source: Susquehanna Financial Group

[1] A lead time measures the time taken to create a product and deliver it to a consumer.

Extract 1: Global shortage of semiconductor

The global semiconductor or computer chips shortage made worse by the coronavirus pandemic and supply chain issues shows no signs of improving as industries worldwide have had to halt production while waiting for processors. A report from the United States (US) Department of Commerce released this week revealed an "alarming" shortage of computer chips at a time when the median demand for them was as much as 17% higher in 2021 than 2019. "This is a major supply and demand mismatch," the report stated.

The consumer electronics market took off during the pandemic. Companies and their employees increased their purchases of desktops and laptops for home-office use, and consumers leaned into purchases of a wide variety of devices such as televisions, gaming systems, headphones, and other electronics equipment. Furthermore, a recent surge in coronavirus cases in Malaysia, Vietnam, and the Philippines has further exacerbated problems in an already hobbled computer chip manufacturing and supply chain market.

In 2021, the dearth of computer chips forced car manufacturers to close down manufacturing and cut production by as much as 7.7 million cars; that, in turn, led to a massive car shortage just as some nations began lifting widespread quarantines, allowing people to travel again.

The chip manufacturing is not instant. It takes three or four months to begin to manufacture a chip, let alone to have it ready to ship. Those chips then have to be embedded into the various systems that make up any given product, such as a car or its various subsystems — and that means shipping chips to Asia, where most product manufacturing occurs.

Since the semiconductor shortage began, manufacturers increased plant production utilisation dramatically, operating at a rate of more than 90% utilisation of their facilities. That high

production rate is unusual because semiconductor machinery requires regular maintenance and uses massive amounts of power. The bottom line: there is not enough manufacturing capacity to meet the spike in demand.

Source: Computerworld, 26 January 2022

Extract 2: Auto market hobbled by global chip shortage

Around the world, auto assembly lines are going quiet, workers are idle and dealership parking lots are looking bare. A shortage of semiconductors, the tiny but critical chips used to calibrate cars' fuel injection, run infotainment systems or provide the brains for cruise control, has upended automaking.

A General Motors plant in Kansas City closed in February for lack of chips, and still hasn't reopened. Mercedes-Benz has begun to hoard its semiconductors for expensive models and is temporarily shutting down factories that produce lower-priced C-Class sedans. Porsche warned dealers in the United States this month that customers might have to wait an extra 12 weeks to get their cars, because they lack a chip used to monitor tire pressure.

The disruption could not come at a worse time. Demand for cars has bounced back strongly from the pandemic slump, with consumers ready to spend money they saved over the past year, eager to avoid airplanes by taking road trips. The supply of semiconductors is depriving carmakers of a chance to make up sales they lost. "We have already a robust demand situation being more held back by the semiconductor issue than anything else," Ola Källenius, the chief executive of Daimler, said in an interview.

Source: The New York Times, 14 October 2021

Extract 3: Shift to public transport in UK

Shifting to electric vehicles will still leave the United Kingdom (UK) with serious transport problems, a report has said. The Institute for Public Policy Research (IPPR) think tank said emissions will fall, but the number of cars on the road will continue to grow. It foresaw a 28% increase in car ownership by 2050, leading to more jams and harm to the economy. But the government said it had plans to make transport greener and it was committed to offering people a range of travel options.

The IPPR's proposals to achieve the UK's low-carbon transition fairly include a national guarantee to make it possible to live a good life without needing to own a car. It says this should include seven-day public transport for all areas, and the principle that everyday needs should be accessible within a 20-minute walk, cycle or public transport trip. The report says ministers should introduce a "help-to-move scheme" with grants and loans to help people buy cycles, electric scooters, e-bikes or electric vehicles where they need them.

Source: BBC, 23 June 2021

Extract 4: Huge carbon footprint for the semiconductor market

The semiconductor market has a problem. Demand is booming for computer chips, which are embedded in everything from smartphones and televisions to wind turbines, but it comes at a big cost: a huge carbon footprint. The market presents a paradox. Meeting global climate goals will, in part, rely on semiconductors. They are integral to electric vehicles, solar arrays and wind

turbines. But chip manufacturing also contributes to the climate crisis. It requires huge amounts of energy and water – a chip fabrication plant, or fab, can use millions of gallons of water a day – and creates hazardous waste.

As the semiconductor market finds itself increasingly under the spotlight, it is starting to grapple with its climate impacts. Last week TSMC, the world's largest chipmaker, which supplies chips to Apple, pledged to reach net zero emissions by 2050. The company aims to "broaden our green influence and drive the industry towards low-carbon sustainability", said the TSMC chairman, Mark Lui.

But decarbonizing the market will be a big challenge. TSMC alone uses almost 5% of all Taiwan's electricity, according to figures from Greenpeace, predicted to rise to 7.2% in 2022, and it used about 63 million tons of water in 2019. The company's water use became a controversial topic during Taiwan's drought this year, the country's worst in a half century, which pitted chipmakers against farmers. Chip manufacturing, rather than energy consumption or hardware use, "accounts for most of the carbon output" from electronics devices, the Harvard researcher Udit Gupta and co-authors wrote in a 2020 paper.

However, amid pressure from investors and electronics makers keen to report greener supply chains to customers, the semiconductor business has been ramping up action on tackling its climate footprint. Greater availability of renewable energy is helping chipmakers reduce their carbon footprint. Intel made a commitment to source 100% of its energy from renewable sources by 2030, as did TSMC, but with a deadline of 2050. Energy consumption accounts for 62% of TSMC's emissions, said a company spokesperson, Nina Kao. The company signed a 20-year deal last year with the Danish energy firm Orsted, buying all the energy from a 920-megawatt offshore windfarm Orsted is building in the Taiwan Strait.

To some observers of the chip business, the determination to clean up the market seems real. The vast demand for chips at the moment will only help the semiconductor market embrace sustainability goals, said Mark Li, a semiconductor analyst at the investment firm Bernstein. "Semiconductor firms have very good margins and make lots of money. So even though all these green carbon measures would have a cost, they can afford it. And increasingly, customers are willing to pay more for a greener device," he said.

Source: The Guardian, 18 September 2021

Extract 5: Two ways to reduce carbon emissions

Carbon pricing is a tried way to put a price on – and thereby discourage – the damages from carbon discharges. One way to do this is to add to the price of a polluting product, example semiconductor, by levying a carbon tax equivalent to the estimated damage of a tonne of discharge.

If the tax is big enough, producers would cut pollution to avoid paying the tax. But where this doesn't happen, the tax revenue raised could support cleaner fuels. More than 40 countries, including Singapore and several member countries of the European Union (EU), have adopted carbon taxes, albeit at different stages of implementation and widely varying rates.

A second approach, followed by China, Japan and South Korea among others, is emissions trading, also known as cap and trade. Some 40 countries have such schemes, but at varying stages of implementation. Some have both a carbon tax and carbon trading, as many members of the EU do. This specifies the maximum allowable emissions for companies, and then issues emission permits that add up to this level. These permits can be traded, from which a price of carbon emerges.

Source: Channel NewsAsia, 16 February 2022

Questions

(a) With reference to Figure 1, describe the trend in the lead time for semiconductor from 2017 to 2022. [2]

(b) Semiconductor manufacturers increased their plant production utilisation dramatically in response to the semiconductor shortage (Extract 1).

Identify and explain one unintended consequence faced by the semiconductor manufacturers when increasing their plant production utilisation dramatically. [2]

(c) In view of the global semiconductor shortage (Extract 1) and using a diagram, explain how a lifting of widespread quarantines is likely to affect the extent of change in the equilibrium quantity of cars. [5]

(d) Using the concept of opportunity cost, explain why it is rational for Mercedes Benz to hoard its semiconductors for its more expensive models (Extract 2). [3]

(e) Explain why public transport is not considered a public good. [4]

(f) Comment on how government intervention through the use of tradable permits could achieve allocative efficiency in the semiconductor market. [6]

(g) Using demand and supply analysis, discuss the reasons for the global shortage of semiconductor. [8]

(h) Intel made a commitment to source 100% of its energy from renewable sources by 2030 (Extract 4).

Discuss whether a country relying on semiconductor firms to reduce carbon footprint on their own is more appropriate than adopting a carbon tax to address allocative inefficiency in the semiconductor market. [10]

[Total: 40]

Question 3: Adapted from 2019 VJC H1 Prelim Q2

The Market for Sugar

Table 3: World production and consumption of sugar, 2014 – 2017

	Production (in million metric tons)	Consumption (in million metric tons)	Average price for sugar worldwide (nominal USD per kg)
2014	181.3	176	0.37
2015	180.7	178.7	0.3
2016	174.7	180	0.4
2017	178	181	n/a

Source: Statista, 2019

Extract 5: The War on Sugar's Biggest Casualty: Global Prices

Sugar prices are hovering near a three-year low as food companies around the world reduce sugar in their products and move toward alternative sweeteners amid health concerns including diabetes, obesity and heart disease.
The problem with demand is due to shifting consumer tastes. Consumers are leaving sugary beverages behind in favour of unsweetened iced teas and flavoured seltzer waters. That has major beverage companies shifting priorities. In Spain, PepsiCo said it has brought down the amount of sugar in its products by 29 percent compared with 2006 and is working toward the goal of two-thirds of its soft drinks containing fewer than 100 calories.

While this heralds ashift in demand for sugar, supply of the commodity is increasing. In its monthly update for July, the International Sugar Organisation says a record sugar surplus expected this year, followed by a surplus next year, means excessive stocks of sugar will take time to liquidate. And producers aren't cutting back. Sugarcane farmers in India are expanding their plantations following subsidies to boost sugar exports that are encouraging production. That is despite the fact that the country, the world's second-largest producer behind Brazil, has produced 6.5 million tons more sugar than it uses over the year that ends Sept. 30.

Source: The Wall Street Journal, Aug 2018

Extract 6: Rise in minimum price for sugar in India

India, which vies with Brazil as the top sugar producer, increased the minimum selling price of sugar by 6.9 percent to help sugar mills. The selling price for millers was raised to 31 rupees (44 cents) per kilogram from 29 rupees at present, according to a government notification on 14 February 2019. The benchmark price is effective immediately.

A rise in the state-controlled price may prompt millers to sell more locally. The government spending has been rising with the increase in sugar stockpiles in India, where production is set to exceed local demand for a second year.

Source: Bloomberg, Feb 2019

Extract 7: Uncertain effects of sugar rush on consumers

Analysts say the increased supply of sugar - not just from the UK, but from other major EU producers - should ultimately lead to lower prices in future. However, the effect on sugary products, like cola and sponge cake, will be more muted, because the cost of sugar only makes up a small part of the overall price of those goods

Sugary products, for example soft drinks, cakes and pastries, are dubbed as the main causes of why children in England are consuming twice as much sugar as recommended. The excess sugars consumed by children increase their risk of childhood obesity. Ignorant of the harmful effects of obesity on themselves, children continue to consume unnecessary amount of sugars.

Consumption of such sugary products may also have led to harmful effects on society. These include the strain on healthcare services from obesity-related diseases, such as diabetes, as well as reductions in labour productivity and rising sickness absenteeism for firms. This worrying trend has prompted the UK government to impose a sugar tax on soft drinks earlier in April 2018. Officially called the Soft Drinks Industry Levy (SDIL), the tax puts a charge of 24 pence on drinks containing 8g of sugar per 100ml and 18 pence a litre on those with 5-8g of sugar per 100ml, directly payable by manufacturers to HM Revenue and Customs (HMRC). As part of the Government's childhood obesity strategy, it aims to reduce sugar consumption by persuading companies to reformulate their high sugar brands and avoid paying the levy.

In addition, a host of measures including restrictions on the advertising of junk food to children, action on price promotions on unhealthy products and clearer food labelling will help parents to make healthy choices and ensure their children have the healthiest possible start in life

Source: BBC News and London School of Hygiene and Tropical Medicine, June 2018

Extract 8: Sugar and Britain's obesity crisis

The effectiveness of the sugar tax to reduce sugar consumption remains questionable. Food manufacturers and supermarkets have only managed to cut 2% of sugar content. Meanwhile the obesity figures continue to rise relentlessly.

Some also worry that the increase in the price of high-sugar drinks due to a sugar tax could lead to an increase in the purchase of beer, diet drinks and juice. Researchers find that alcohol and alternative drink options could act as substitutes.

Funds raised from the sugar tax are earmarked for spending on school sports programmes and breakfast clubs, as part of wider efforts to combat childhood obesity. The initial forecast was that the tax would bring in £520 million in its first year of operation, but this was revised down to £275 million as a result of company efforts to remove sugar from their products. Data from the first full year of the tax is not yet available, but receipts from April to October 2018 totalled £154 million.

Dr Laura Cornelsen, assistant professor in public health economics and MRC Career Development Fellow at the London School of Hygiene & Tropical Medicine, says this highlights that changing behaviour is really difficult, particularly when people who have been used to the same product for years say they really like it. She adds, “Changing behaviour is really difficult and strong preferences and habits mean the price responsiveness is likely to be lower.”

The levy on sugary drinks is not a silver bullet to fix unhealthy diets. While it is a step in the right direction, more is likely needed to be done.

Source: Guardian, Oct 2015 and London School of Hygiene and Tropical Medicine, June 2018 and Rathbone Greenbank Investments, Apr 2019

Questions

(a) Using Table 3, account for the change in average prices for sugar worldwide from 2014 to 2016. [4]

(b) (i) With the help of a diagram, explain why ’government spending has been rising with the increase in sugar stockpiles in India’ (Extract 6). [3]

(ii) Using the concept of price elasticity of demand, explain how the rise in the minimum price will affect consumer expenditure on sugar in India and comment on whether you believe such an impact is certain. [6]

(c) (i) With reference to Extract 7, assess **two** reasons why the British government would like to intervene in the market for soft drinks. [8]

(ii) An absolute ban is an extreme form of quantity control.

Explain **two** possible factors that the UK government should consider in deciding whether to impose a ban on sugary drinks. [6]

Topical Assignment:

(iii) With reference to Extracts 7 and 8, discuss the view that sugar tax used by the UK government, is the most effective policy measure to address the problem of overconsumption of sugary products. [10]

[Total: 40]

Question 4: 2023 ASRJC H1 Prelim P1Q1

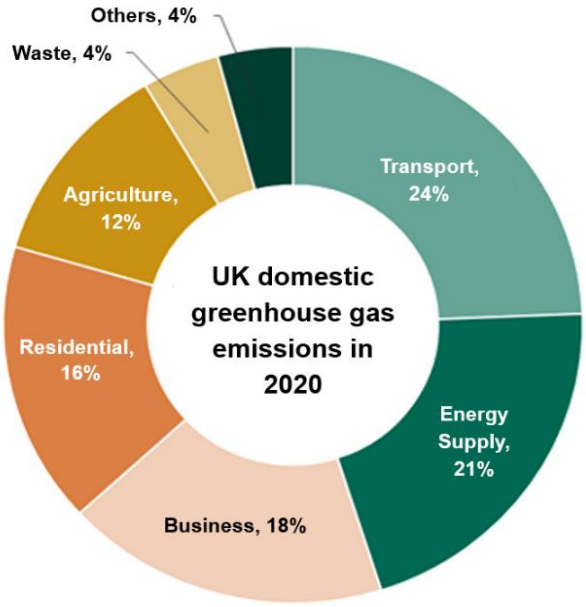
The Electric Vehicle and Energy Market

Table 1: Selected countries' share of electricity production from nuclear sources (%)

Country	2015	2016	2017	2018	2019	2020	2021	2022
France	76.22	72.17	71.64	71.71	70.53	67.11	68.93	63.30
United Kingdom	20.98	21.33	20.99	19.69	17.47	16.54	15.26	14.82
Germany	14.33	13.16	11.81	12.01	12.52	11.35	11.89	6.27
Japan	0.32	1.48	2.75	4.73	6.44	4.34	6.39	5.36

Source: Energy Institute Statistical Review of World Energy, accessed 19 July 2023

Figure 1: Greenhouse gas emissions by source in the UK, 2020 (%)



Source: www.gov.uk, accessed 19 July 2023

Extract 1: Electric vehicle sales reach new highs but knowledge gaps remain

Today's electric vehicles (EVs) are beyond anything nineteenth century drivers could imagine. From intelligent driving to proactive service and remote vehicle access, EVs can offer the safety and convenience today's consumers crave. With the rise in demand, EV sales in the United Kingdom (UK) are booming and traditional car manufacturers are ramping up their EV productions to meet the demand. With consumers aiming for a more sustainable future, it's not surprising that

owning a car with lower carbon emissions has become desirable for many. This is great news in terms of addressing the underconsumption issue as EVs are expected to result in positive social benefits by way of reduced pollution emissions and because of the associated decrease in the consumption of gasoline that EV adoption would bring about. But environmental concerns are not the only reasons people give for wanting an EV; potential buyers also cited the benefits of fuel and cost savings. These factors are so appealing that intenders are willing to pay more for a new EV than they might for a conventionally fuelled equivalent.

However, there are still plenty of misunderstandings and false rumors about EVs, and the effect they have on vehicle sales is all too real. Half of potential buyers are still concerned about battery life and nearly a third also cite a lack of knowledge as a potential blocker for making a purchase, with 32% saying they do not understand the full benefits of purchasing an EV. For example, while the majority know that EVs run on electricity, some aren't so sure. Ford recently conducted an in-depth study on the public opinion of EVs and found that lack of knowledge is a major deterrent to purchasing. The study found that 90% of Americans and Europeans believe EVs have poor acceleration. However, the reality is that the Tesla Model S is the fastest accelerating sedan on the planet. Overall, besides the EV subsidies given by various governments across the world, the study has revealed a need for more education to help the public understand what EVs can and cannot do.

Sources: adapted from https://ibm.com, https://marketingweek.com and https://sciencedirect.com, accessed 19 July 2023

Extract 2: Japan plans to approve the building of nuclear power plants

As part of a big energy policy shift announced by Prime Minister Fumio Kishida, Japan plans to approve the building of nuclear power plants for the first time since the disaster at the Fukushima nuclear plant following the country's March 2011 earthquake and subsequent tsunami. The Ministry of Economy, Trade and Industry revealed details of the plans this week, saying they would also create a path for some reactors to remain in operation for more than 60 years. Nuclear power - considered one of the cleanest sources of electricity from a sustainability perspective - is likely to account for an increasing share of Japan's energy mix.

One feature of the new-generation plants is that they would be easier to run for short bursts or at reduced output. This would make them easier to use alongside renewable energy sources such as wind and solar power, which are dependent on weather and time of day. Japan's ability to develop renewable energy is limited by its relatively small available land and deep offshore waters. Reliance on coal to provide a stable power source clashes with the aim of reducing carbon emissions. This is why nuclear power - which combines a stable supply and low generation costs with decarbonization - is again becoming a feasible alternative. However, even before Japan builds new nuclear power plants, it needs to restart some existing facilities while dispelling doubts about their safety since the Fukushima accident.

Source: https://asia.nikkei.com, 29 November 2022

Extract 3: Germany has shut down its last three nuclear power plants, and some climate scientists are aghast

A collection of esteemed scientists, including two Nobel laureates and university professors, made a last-minute plea in an open letter on the nuclear advocacy group's website, *RePlaneteers*, to

keep the reactors operating. “In view of the threat that climate change poses to life on our planet and the obvious energy crisis in which Germany and Europe find themselves due to the unavailability of Russian natural gas, which causes energy cost to soar, we call on you to continue operating the last remaining German nuclear power plants,” the letter states. However, the open letter did not succeed in keeping the nuclear reactors open.

The German government says it is making the country safer by closing down the nuclear reactors. The nuclear phase-out makes Germany safer and avoids additional high-level radioactive waste. Volker Quaschning, a professor of renewable energy at the Hochschule für Technik und Wirtschaft Berlin, supports Germany closing its nuclear reactors because of the risk of an accident. “Nuclear energy is a risky technology. During the Chernobyl reactor accident, Germany was hit by radioactive fallout. A reactor accident would make large parts of Germany uninhabitable. In the course of global uncertainties, the risks for nuclear energy are also increasing”, Quaschning told CNBC. Also, radioactive waste management is “still unsolved in Germany as it is expensive, and no one in Germany wants a repository for highly radioactive waste near them.”

Turning off the nuclear reactors opens the doors for renewables to be the future of energy, Niklas Höhne, a professor at Wageningen University, told CNBC. “In the German context, the phase-out of nuclear energy is good for the climate in the long term. It provides investment certainty for renewable energy; renewables will be much faster, cheaper and safer than expansion of nuclear energy,” Höhne told CNBC. Nuclear energy is also often more expensive than wind and solar power, Quaschning said, adding, “there are no longer any real advantages with nuclear energy.”

Source: https://cnbc.com, 18 April 2023

Extract 4: Government intervention in the market for fossil fuel

Fossil fuels subsidies

Globally, fossil fuel subsidies were $5.9 trillion or 6.8% of GDP in 2020 and are expected to increase to 7.4% of GDP in 2025 as the share of fuel consumption in emerging markets (where price gaps are generally larger) continues to climb. Subsidies are intended to protect consumers by keeping prices low, but they come at a high cost. Subsidies have sizable fiscal costs, promote inefficient allocation of an economy’s resources and encourage pollution (contributing to climate change and premature deaths from local air pollution). Removing subsidies and using the revenue gain for better targeted social spending, reductions in inefficient taxes, and productive investments can promote sustainable and equitable outcomes.

Carbon taxes on fossil fuels

Carbon taxes are charges on the carbon content of fossil fuels. Their principal rationale is that they are generally an effective tool for meeting domestic emission mitigation commitments. Also, carbon taxes can generate significant domestic environmental benefits —for example, reductions in the number of people dying prematurely from exposure to local air pollution caused by fossil fuel combustion to generate power. Because these taxes increase the prices of fossil fuels, electricity, and general consumer products, they promote switching to lower-carbon fuels in power generation, conserving on energy use, and shifting to cleaner vehicles, among other things. A tax of, say, $35 a ton on carbon emissions in 2030 would typically increase prices for coal, electricity, and gasoline by about 100%, 25%, and 10%, respectively. Carbon taxes also provide a clear incentive for redirecting energy investment toward low-carbon technologies like renewable power plants.

Another important argument for carbon taxes is that they could raise a significant amount of tax revenue. Using this revenue productively to benefit a country's economy could help offset the harmful macroeconomic effects - reduced employment and investment - of higher energy prices. For advanced economies, for example, the revenue might be used mostly to cut taxes on labour and capital income, implying a revising of the tax system rather than an increase in the overall tax burden. For developing countries unable to mobilise adequate revenue from broader taxes because of low economic activities, carbon tax revenues might be used mostly to fund investments for achieving sustainable growth. In all countries, use of some revenues to fund clean-energy infrastructure upfront could enhance carbon pricing's effectiveness and credibility.

Sources: https://imf.org/, December 2019

Questions

(a) With reference to Table 1, compare the share of electricity production from nuclear sources in Japan with that in other countries from 2015 to 2022. [3]

(b) The price mechanism allocates scarce resources in the free market through signalling, incentive and rationing functions.

With the change in demand for electric vehicles (EVs) mentioned in Extract 1, explain how the price mechanism is able to perform any two of its functions in the EV market. [5]

(c) (i) With reference to the data, explain and comment on two reasons that resulted in the underconsumption of EVs from society's perspective expressed in Extract 1. [6]

(ii) Using a diagram, explain how EV subsidies can improve resource allocation when positive externailities exist. [4]

(d) Explain how the building of nuclear power plants in Japan will result in changes in the supply curve of nuclear energy. [4]

(e) Using Extracts 2 and 3, discuss the factors that are likely to influence a government's decision to follow Japan's plan "to approve the building of nuclear power plants". [8]

(f) Extract 4 suggests that some countries subsidise the consumption of fossil fuels while other countries impose tax on carbon content of fossil fuels.

In view of the concepts of efficiency and equity, discuss whether government intervention in the fossil fuel market does more harm than good. [10]

[Total: 40]