H2 Market Failure Tutorial 2023: Suggested Answers

Question 4: Policies for health improvement (Adapted from H2 A Level 2018)

(a)(i) Using the information in Extract 1, calculate the value of the price elasticity of demand for sugar-sweetened beverages (SSBs). [2]

Question approach & marks scheme:

- Apply the formula of PED to calculate the PED value of SSBs.
- 1m: formula of PED
- 1m: value

Suggested answer:

- Price Elasticity of Demand measures the degree of responsiveness of consumers to a change in the price of the good, ceteris paribus. It can be calculated using the formula: % change in quantity demanded / % change in price of the good.
- Using Extract 1, PED value of SSBs = | (-24%) / (+20%) | = 1.2

(a)(ii) Explain one possible factor that could lead to this value. [2]

Question approach:

• Using Extract 1, identify one possible factor and explain how it causes PED value > 1.

Suggested answer:

- There is a large number of substitutes for SSBs such as fruit juice and healthier beverages.
- Therefore, the demand for SSBs is price elastic as consumers would readily switch to consuming these substitutes when the price of SSBs increase.

Note: Other acceptable answers include the high proportion of spending on SSBs by lowincome and younger consumers OR SSBs not being considered as a necessity by consumers.

(b)(i) State the economic concept you would use to measure the relationship between the change in the price of SSBs as sales taxes are imposed and the resulting change in the demand for bottled water. [1]

Suggested answer:

• Cross Elasticity of Demand (XED).

(b)(ii) Explain the value you would expect to get from this measurement. [3]

Question approach and mark scheme:

- 1m: positive sign of XED
- 1m: magnitude of XED
- 1m: explain why the sign and magnitude

Suggested answer:

- Sign of XED value: The XED value obtained will be positive because bottled water and SSBs are substitutes. As price of SSBs to increase → quantity demanded of SSBs decreases → increase in demand for bottled water when SSBs consumers switch over.
- Magnitude of XED value: The greater the magnitude of the value, the stronger the relationship between the two products in terms of their substitutability.
- In this case, bottled water and SSBs cannot be considered as close substitutes as one contains sugar but bottled water does not. Hence, even though they are both beverages, they give different level of satisfactions to the consumers. This will result in only a small proportion of consumers switching over to bottled water when price of SSBs increase. Hence, XED value between bottled water and SSBs is likely to be less than 1 in magnitude.

(c) Discuss whether consumers would ever make rational decisions regarding their consumption of SSBs. [8]

Question analysis:

Command word	Discuss:
	- Provide a balanced argument
	- Evaluate
Concepts to use	Perceived vs actual MPB and MPC
Context	Market for SSBs

Introduction

- Unpack what it means by making rational decisions. In the case of consumers, **they aim to maximize their total net utility / satisfaction.** This requires consumers to **consume at a consumption level where marginal private benefit = marginal private cost.**
- In their consumption of SSBs, the presence of imperfect information arises as consumers do not have perfect information on the true costs and benefits of their consumption decisions. This prevents them from maximizing their total net utility / satisfaction.

Requirement 1: Explain how consumers make rational decisions

- In the case of consumers, they aim to maximize their total net utility / satisfaction. This requires consumers to consume at a consumption level where marginal private benefit = marginal private cost.
- If MPB > MPC for the additional unit consumed, consumers would increase consumption as it would increase their total utility.
- If MPB < MPC for the additional unit consumed, consumers would not consume more, as it would decrease their total utility.
- Thus, self-interested and rational consumers would consume at MPB = MPC provided they have estimated MPB and MPC accurately.

Requirement 2: Explain how imperfect information has prevented consumers from making rational decisions

- <u>Explaining perceived < actual cost</u>: In the consumption of SSBs, consumers may at times be affected by misleading marketing and product differentiation efforts (Extract 2: marketing and advertising products are very powerful influences on consumer demand"), hence causing either perceived cost to be lower than actual cost or perceived benefit to be higher than actual benefit. For instance, soda producers may choose to conceal the high sugar content of soda in their attempts to make soda a seemingly-healthier alternative.
- <u>Explaining Q_m > Q_s</u>: Consumers therefore perceive their marginal private cost to be lower than the actual marginal private cost, hence causing market equilibrium output level to be at Q_m where MPC_{perceived} = MPB, while the allocatively efficient consumption level for the society is at Qs where MPC_{actual} = MPB. As Q_m is higher than Q_s, SSBs have been overconsumed by Q_m - Q_s units, suggesting that too much resources have been allocated to the market for SSBs.
- <u>Explaining welfare / deadweight loss:</u> Consumers a welfare / deadweight loss due to the overconsumption of SSBs. This can come in the form of medical costs for diabetes treatment caused by overconsumption of SSBs (Extract 1: "increased obesity amongst populations and a consequent rise in diseases such as diabetes and heart disease"). As shown in the figure below, welfare / deadweight loss is shown by the area ABC. Thus, the consumers fail to make a rational decision.



<u>Balanced Argument / Synthesis:</u> Whether they can ever make rational decisions depends on the presence of external nudges in the form of government intervention such as sugar tax or subsidies on alternatives.

- Government interventions that can change the perceived costs and benefits of consuming SSBs include advertising regulations for producers to prevent misinformation, or advertising the "no-sugar options available" (Extract 3) or using fiscal policies to "influence consumers to make healthier choice and reduce consumption of SSBs through making sodas more expensive than bottled water" (Extract 2) via sugar tax.
- With a more expensive SSBs, the marginal private cost to the consumers will likely increase and hence, closing the gap between the perceived and the actual private cost.
- If left on their own without external nudges, the imperfect information will persist in the market, leading to the consumers overconsuming SSBs, resulting in the welfare loss to the society.

- Hence, if the governments want the consumers to behave rationally, they need to intervene in the form of tax or subsidies or both. Even so, it is not guaranteed that all consumers will change their perceived costs and benefits towards SSBs, especially the more addicted consumers.
- (d) Discuss whether fiscal intervention is the best government policy to deal with the problems caused by over-consumption of SSBs. [10]

Question analysis:

Command word	Discuss:
	- Provide a balanced argument: fiscal intervention vs other policies
	- Evaluate which is the best policy
Concepts to use	Cost/benefit diagram and framework
	Fiscal intervention: taxes/subsidies
Context	Market for SSBs

Introduction:

- Government intervention typically takes place in cases where market-based decisions fail to allocate resources in an efficient and equitable way.
- In the case of SSBs consumption, the market has failed due to the presence of imperfect information (Extract 2), and negative externalities (Extract 1).
- Governments aim to achieve allocative efficiency (AE) in resource allocation so that the society's welfare is maximised. AE condition: An efficient allocation of resources requires the production or consumption level to be at the point where Marginal Social Benefit (MSB) = Marginal Social Cost (MSC). When MSB = MSC, total net benefit to society is maximised.
- To correct this market failure and reduce the health problems that result, governments can implement policies such as fiscal intervention, public education and encouraging firms to develop healthier beverages.

<u>Requirement 1: Explain how fiscal intervention in the form of indirect taxes and</u> <u>subsidies can help to reduce over-consumption of SSBs.</u>

- As shown in the figure below, a sugar tax amount equivalent to the MEC generated at Q_s (distance BE_m) will increase the MPC of consuming SSBs, as the tax increases the price of the SSBs from P_m to P_s.
- By forcing consumers to internalize the external cost in their private cost valuation, the consumption of SSBs will fall from Q_m to Q_s.
- This **removes the welfare loss** created previously as the reduction in obesity and health problems would mean a smaller negative impact on the country's productivity levels and economic growth.
- Extract 1 supports the use of taxes ("as taxes increase, the purchase price of certain foods increases and consumers thus reduce their purchases").



Evaluation of taxes:

- <u>Strengths</u>: Taxes are highly effective and able to achieve results within a short period of time. Given that the demand for SSBs is price elastic (Extract 1) due to the presence of other close substitutes such as healthier alternatives (fruit juices) that consumers can switch to, the increase in price of SSBs will bring about a more than proportionate decrease in quantity demanded, ceteris paribus.
- In addition, taxes increase revenue for the government, which can be reinvested into obesity prevention, for example by providing water fountains in schools (Extract 2)
- <u>Limitations</u>: However, taxes also have unintended consequences. Taxes reduce the profits of firms and could harm firms in the SSB supply chain, such as farmers, manufacturers and convenience stores. With lower consumption of SSBs, firms produce less and require fewer workers, which could result in job losses. For example, there could be a loss of more than 4000 jobs across the UK. (Extract 3)

Another form of fiscal policy is the **subsidies of healthier alternatives** like non-sweetened beverages. As tax increased the price of SSBs, it **may force consumers to switch over to cheaper alternatives, creating higher demand for healthier choices and reduce the consumption of SSBs.** Hence, by providing subsidies on healthier alternatives, it will further encourage consumers to switch from consuming the more expensive SSBs to cheaper and healthier alternatives. (Extract 1 and 2)

The subsidies can include

- 1) subsidizing the R&D of healthier choices and/or
- 2) subsidizing the production cost and/or
- 3) subsidizing the consumers in their purchase of healthier options
- Government subsidies on healthier alternatives can help to absorb part of the high production cost (e.g. R&D cost of reformulating the drinks) incurred in producing healthier alternatives.
- A lower COP will hence increase the supply of the healthier choice. Supply curve shifts rightwards from S to S₁ as a result. As shown in the figure below, as long as the increase in supply is able to exceed the increase in demand, overall prices of healthier alternatives would still fall from P_e to P₁, despite the switching over of SSBs consumers after the imposition of sugar tax.



Market for Healthier Beverages

Evaluation of subsidies:

- <u>Strengths</u>: Given that the **demand** of healthier alternatives is **price elastic**, the subsidies are likely going to be very effective in raising the consumption of fruits and vegetables (Extract 1).
- <u>Limitations</u>: However, the use of subsidies may not be feasible for governments that have been running persistent budget deficits, hence lacking the funds to finance the subsidies. However, this limitation can be over-come if the government uses the tax revenue generated from the indirect taxes imposed.

<u>Transition to the next policy</u>: However, the use of fiscal intervention alone is not able to effectively correct imperfect information causing market failure in the market of SSBs. Hence, public education should also be used to reduce overconsumption of SSBs.

Requirement 2: Explain how public education helps to reduce overconsumption of SSBs

- Governments can use public education to educate the public and inform them about the full extent of benefits or harmful effects of the good on themselves as well as the society. This is aimed at getting people to decide on the right amount of consumption for the good.
- Educating the public on the harmful effects of consuming SSBs such as obesity/diabetes and other healthcare concerns on themselves can increase their private cost of consumption of SSBs, reducing the difference between actual and perceived costs.
- The public education will increase the MPC (perceived) to the MPC (actual), leading to the drop in consumption from Qm to Qs. This will ensure consumption of SSBs at the allocative efficient level.
- The government could also advertise the no-sugar options available (Extract 3).



Evaluation of public education: However, education takes a long time to achieve the intended results. Hence, if a reduction in consumption is to be seen quickly, the use of public education should be complemented with policies that can work faster such as fiscal intervention.

Synthesis/Summative Evaluation:

- Governments should note that if SSBs become more expensive after taxation but still remain cheaper than healthier alternatives, the switching over effect would be limited. Hence, for fiscal intervention to be successful, sufficient subsidies must be given to reduce the prices of healthier alternatives so that they become cheaper than SSBs.
- Instead of debating over which is the best policy, governments should consider using all the policies together as they are <u>complementary</u>.
 - For example, the revenue earned from taxes can be used to finance the other policies such as subsidies or public education.
 - In addition, policies such as fiscal intervention and public education all aim to lower consumption, which has the intended consequence of creating unemployment in the SSB and related industries. Thus, these policies must be used together with the reformulation of drinks, so that consumption and production can remain high, and jobs would be less affected.

Section C: Essay Questions

- **5.** The Singapore government uses the Certificate of Entitlement (COE) system, the electronic road pricing (ERP) system, and the improvement of the public transport system to address the problem of traffic congestion.
 - (a) Explain why traffic congestion leads to market failure. [10]
 - (b) Evaluate the various policies the Singapore government can use to reduce [15] traffic congestion.

(ACJC Mid-Year Assessment 2015)

(a)	Explain why traffic congestion leads to market failure.	[10]
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Question Analysis:

Command word	- Explain: students are to elaborate on the causal links between a cause and effect. For this question,
	 Cause (start) = traffic congestion from the usage of cars
	 Effect (end) = market failure, society's welfare is not maximised
Content	 Market failure analysis using cost/benefit diagram Sources of market failure: negative externalities and imperfect
	information.
Context	Market for road usage / road trips
	Decision making by road users

<u>Intro</u>

- Market fails when the price mechanism fails to bring about efficient allocation of resources, leading to welfare loss incurred.
- Governments will intervene when the market fails, since their aim is to maximise social welfare.
- The presence of negative externalities, which is the negative spillover effects on third parties, and are not compensated for these negative spillover effects, as well as imperfect information can lead to an over-consumption of cars.

<u>Body</u>

Requirement 1: Explain how negative externalities from the usage of cars result in traffic congestion and market failure.

1. Explain the market equilibrium, rational car drivers:

- When considering whether to use the car, owners only **consider the marginal private benefit (MPB) and marginal private cost (MPC)** of using the car.
- MPB of using the car includes the *additional* convenience and the satisfaction derived from driving the car.
- MPC of using the car includes the *additional* petrol cost, additional cost of servicing the car when using the car.
- To maximise their own private satisfaction, the free market equilibrium will occur at Em, when MPC intersects MPB to give equilibrium quantity of Q_m, which is the market level of consumption of cars.



[Note: MSC and MPC only diverges after a certain quantity of road trips, as there is no congestions if the roads are empty enough.]

2. Explain the presence of negative externalities:

- However, the usage of cars generate negative externalities.
- Some examples of the negative externalities and hence, marginal external costs (MEC) are:
 - **Traffic congestion.** This would then lead to **loss in man hours and possibly decline** in productivity for 3rd parties such as **businesses** as employees come late for work.
 - Noise, air pollution. The exhaust fumes from the car usage can pollute the air, which could harm pedestrians on the sidewalks, leading to possible respiratory illnesses. Due to the respiratory illnesses, the third parties like pedestrians would have to seek medical advice, incurring additional medical costs.
- The presence of these MEC will cause a divergence between MPC and MSC, where **MSC** is greater than MPC (as shown in the diagram below).

3. Explain the socially optimal equilibrium:

- The socially optimal level of output is where MSC intersects MSB at E2, to give output Q2.
- At this output, this is where social welfare is maximized.

4. Consequences of the difference in equilibrium:

- Since Q₁ is larger than Q₂, from society's point of view, there is an overconsumption of cars. From society's point of view, there is an overconsumption of cars, which is the usage of cars, of Q₁Q₂ units and the welfare of society is not maximized.
- For every unit of car that is consumed above Qs, the society incurs a greater additional social cost than the additional benefit it enjoys.
- Additional cost of consuming Q_1Q_2 units is $AE_2Q_2Q_1$ and the additional benefit is $E_2E_1Q_1Q_2$
- Since additional cost is greater than additional benefit, there is a welfare loss represented by the triangular area of AE₂E₁

Requirement 2: Explain how imperfect information in the usage of cars result in traffic congestion and market failure.



1. Explaining perceived market equilibrium

• Drivers would take up to Q_m number of road trips based on their perceived marginal private benefit and perceived marginal private cost.

2. Explain the presence of imperfect information (on their own MPC / MPB)

- However, at this quantity Q_m, it does not maximize their welfare.
- This is because drivers often do not have perfect information about the true costs and benefits on themselves.
- For example, they might not be aware that some roads are congested due to accidents, therefore, the road journey may take longer than expected and ended up using more fuel.
- This means that the drivers **underestimated the marginal private cost** to themselves of using their car.

3. Explaining true market equilibrium

• Therefore, should there be perfect information, the ideal market level of consumption of cars should be at the MPC actual = MPB actual, at output Qs.

4. <u>Consequences of the difference equilibriums:</u>

- Since the Qm is greater than the Qs, there is **overconsumption** of cars. Hence the **market has failed.**
- At Qm, there is welfare loss incurred, due to the higher true costs on some of the drivers who may be stuck in congested traffic conditions.
- Therefore, for every unit of car usage above Qs, there is greater additional private costs of area BCQsQm to the drivers as compared to the additional private benefit of area ACQsQm.
- This means that there is welfare loss of area ABC, where some of the drivers' welfare could be maximized should they have more perfect information of their actions on themselves.

Conclusion:

Since market forces have failed to achieve allocative efficiency, the government needs to intervene to achieve the socially optimal outcome.

(b) Evaluate the various policies the Singapore government can use to [15] reduce traffic congestion.

Question Analysis:

Command word	-	Evaluate: students are to explain the various policies used as well as their limitations, and make a judgement based on a chosen criteria.
Content	-	Market failure analysis using cost/benefit diagram
	-	Policies to correct market failure
Context	-	Market for road usage / road trips
	-	Decision making by road users

Introduction:

- In Singapore, traffic congestion is a major problem due to the limited land area and high usage of cars by the population.
- The Singapore government intervenes in the transport market to reduce traffic congestion and maximise social welfare.
- Existing policies including the COE system, ERP, and an efficient public transport system.

Requirement 1: Explain Policy 1 - the COE system

- Explain how the COE system works to reduce traffic congestion
 - COE represents a right to vehicle ownership and use of the limited road space (for 10 years)
 - It is a quota system as it limits the number of cars that can be on the road. In order to get a COE, one has to bid for the COE.
 - Bidding is an efficient way of allocating resources as the bidders would consider their satisfaction they would get when using the car and would then bid the maximum value they are willing to pay for the COE
 - As demand increases, the price of COE will rise and become less affordable for consumers. This will discourage some consumers from buying cars and reduce the car population.
 - $\circ~$ This policy is easy to implement and monitor as it is illegal to buy a car without a COE
 - The quota system provides certainty of outcome by controlling the car population
 - Quantity of transport consumed is reduced to the socially optimal equilibrium
- Limitations
 - However, this measure does not address the market failure caused by usage of cars. Rather, it targets the problem indirectly by controlling car ownership. While this could address the market failure brought about by car usage, the problem is that it can lead to over-correction, i.e. too blunt, where people who may not use the car often or do not use the car during peak hours, are also required to pay for the COE, discouraging them from buying a car.
 - On the other hand, the measure might be counter-productive. After having paid a large sum of premium for COE, Singaporeans might use their cars even more. i.e. to spread it the fixed cost. This is due to sunk cost fallacy, where the drivers' current decision to drive is influenced by their past decision to purchase a car.
 - Also, it might result in inequity of distribution issues, as those who need the car more may not be able to afford the COE premium.

Requirement 2: Explain Policy 2 - the ERP system

• Explain how ERP works and its limitations

- ERP is an electronic toll collection scheme to manage the traffic by way of road pricing. It is a usage-based system
- Cars have to pay tolls when they pass by ERP gantries, located at roads leading into the Central Business District and expressways
- $\circ~$ This increases the marginal private cost of using cars, as shown in the diagram below from MPC to MPC + tax



- The amount of tax they pay would be equal to the amount of MEC at quantity Q₂. This causes the drivers to internalize the external cost associated with excessive car usage.
- This measure is easy to implement as all vehicles are fitted with the necessary equipment to allow for payment of the fee when they pass by the gantries.
- Limitations:
 - However, the exact amount of tax to be imposed is not easily determined and the government may over-correct the market failure by imposing a tax that is too high an amount. While the number of vehicles being charged depends on volume of traffic, the government has to decide how much to charge each vehicle and different times of the day.
 - The amount of tax being imposed currently is also negligible compared to the premium that was paid for COE, thus reducing the effectiveness of this policy.

Requirement 3 (optional): Explain policy 3 - improving the public transport system

- Explain how the improvement of public transport would help in reducing the market failure brought about by congestion and its limitations
 - $\circ\,$ In recent years, Singapore's public transport system has seen several improvements
 - The opening of the Circle Line in 2009 and Downtown Line in 2013 aimed to improve the connectivity of the rail network in Singapore.
 - As public transport becomes a faster and cheaper option compared to driving cars, the perceived private benefit of driving cars (i.e. the convenience enjoyed) falls.
 MPB curve shifts to the left, which reduces the market equilibrium quantity of road trips taken.
 - Thus, if the vehicle owners switch to public transport, it will greatly reduce the negative externalities brought about by traffic congestion.
- Limitations:

- However, it is not easy to get the rich and wealthy to switch to taking public transport as they may view public transport as an inferior good. Furthermore, if the drivers have already paid for a car, they would want to utilize their cars as much as they can, driving a car also brings more convenience as compared to taking public transport.
- Also, the proposed improvements to public transport, which sees small towns being connected by the rail network, are only expected to finish in the year 2030. This is a long-term solution and its effects would only be seen in the long run.

Synthesis:

 In order to address the market failure brought about by traffic congestion, a multipronged approach is required where policies implemented would address the limitations of the other policies. For Singapore, policies are aimed at discouraging the use of cars by making it more expensive to do so and by making alternatives like public transport more attractive.

Summative evaluation and conclusion

- The policies that are currently implemented do not solve the problem of market failure completely. However, this may be the best set of solutions that the Singapore government has to deal with the problem, as there has been fine-tuning to both COE and ERP since their implementation.
- Although the COE system does not seem to have fulfilled its purpose of discouraging car usage, it does not mean that it should be discontinued. The bidding process ensures efficiency. It also allows adjustment for increases in income over time. As consumers' income increases, they would be paying more for COE, unlike the ERP measure. As mentioned earlier on, the COE bidding system results in greater inequity. Whether this is worth it depends on whether the society values efficiency over equity.
- In time to come, as Singapore sees a further increase in income, the current ERP rates might no longer be effective in deterring car usage. Perhaps the government can consider raising ERP rates by a substantial amount to cause drivers to feel a greater pinch when using their cars in the city center.

- 6. There is considerable agreement over the need for governments to provide public goods. There is less agreement over the extent to which markets fail because of imperfect information.
 - (a) Explain the case for government intervention in markets for public goods and where information is imperfect. [10]
 - (b) Evaluate the alternative policies that are adopted by the Singapore government to correct for both these types of market failure. [15]

(adapted from: A-Level 2014)

(a)	Explain the case for government intervention in markets for public goods and	
	where information is imperfect.	[10]

Question Analysis:

Command word	- Explain: students are to elaborate on the causal links between a
	cause and effect. For this question,
	 Cause (start 1) = public goods
	- Cause (start 2) = information is imperfect
	- Effect (end) = market failure → need for government intervention
Content	 Market failure analysis using cost/benefit diagram
	- Sources of market failure: public goods and imperfect information
Context	None given, student can use any examples from their own knowledge

Introduction:

Market failure occurs when free market fails to allocate resources equitably and efficiently. Due to the unique characteristics of public goods – non-excludability and non-rivalry – free market will not allocate resources to the production of public goods and hence market fails. While on the other hand where information is not perfect, market may over or under allocate resources in the production of goods. Hence market fails in the case where information is imperfect.

Body:

Requirement 1: Explain how markets may fail in the case of public goods

Markets fail in the case of public goods due to the non-rivalry and non-excludable nature of the goods.

- <u>Non-rival</u>: Public goods such as street lights, traffic lights and national defence are non-rivalry as the consumption of the goods by one person does not diminish the quantity or quality for another person to consume. The usage of street lighting by one person does not diminish the quantity or brightness of the street lighting available for the next person. Since consumption of the goods by one person does not diminish the quantity or quality for another person, the cost of supplying the good to an additional consumer is zero i.e. MC=0. Thus, the condition of allocative efficiency, P=MC implies that the good should be provided free to maximize social welfare. However, producers are not willing to provide the good for free and would set a price at P > MC in order to make profits. Thus, the condition for allocative efficiency is not met, there is underallocation of resources, and the market fails.
- <u>Non-excludable</u>: In addition to non-rivalry, public goods are also non-excludable as once the goods are produced, it is not possible or economically feasible to exclude someone from using the good even if he does not pay for it. Once the street lightings are produced, non-payers can also benefit from the lighting of the street lamps and it is impossible to prevent those non-payers from enjoying the lighting. Therefore there is no incentive for people to pay themselves and reveal their demand leading to free-

rider problem. Firms are unable to charge a price for the good since there is no price signal for the good. Therefore it is unprofitable for private firms to supply the good. As the free market allocates zero resources to the provision of public good, there is complete market failure.

Due to characteristics of non-rivalry and non-excludability, no resources will be allocated to the production of public goods when left to the private sector. The problem of a complete market failure calls for the government to intervene to provide for such goods.

Note: Students may choose to explain non-rejectability (optional), but should prioritise explaining non-rival and non-excludable first.

Requirement 2: Explain how markets may fail in the case of imperfect information

Note: Students may explain either market failure due to asymmetric information OR inaccurate/lack of information. This answer explains the latter. Given the part (b) question that is asked, it is recommended to write market failure due to inaccurate/lack of information as there would be more government policies to expound on.

However, in the case when information is imperfect, there is partial market failure as the free market may over or under allocate the resources.

- This imperfect information arises when producers or consumers do not have accurate and available information to aid their decisions.
- In a free market economy, where resources are allocated through the price mechanism, economic agents' pursuit of self-interest would achieve the socially-optimum output, assuming that they have perfect knowledge about the quality and costs to aid them in their decision-making.
- However, in the real world there is often imperfect knowledge and uncertainty. Benefits and costs are unknown or inaccurately perceived, thus preventing accurate decisions to consume and produce at the socially-optimum level.

Imperfect information may lead to under allocation and over allocation of resources in the market for various goods. For example, the market for vaccinations.



Market for Vaccinations

Consumers may **underestimate the marginal private benefits** of consumption:

• Imperfect information may lead to under allocation of resources hence causing market failure. Merit goods such as vaccinations and education are deemed by the government to be socially desirable. In the consumption of vaccines, consumers consider their marginal private costs and benefits, and consume up to the quantity where their perceived MPB = perceived MPC at quantity Q_M in order to maximize their

utility.

- However, some consumers may not have accurate information about the benefits of vaccinations. For example, a young person may feel they are fit and healthy and have a small chance of falling ill, and therefore do not need the vaccine. Such consumers will underestimate the MPB of vaccines. Thus the perceived MPB is below the actual MPB.
- The consumer's utility is maximized when the actual MPB = actual MPC at the quantity of Q_s . Thus, there is an under consumption of Q_MQ_s in the market for vaccinations.
- For each unit of vaccine consumed from Q_M to Q_S, the MPB is greater than the MPC, and consumers' utility could be increased with more consumption. The welfare loss is indicated by the shaded area. Thus, the market has failed to allocate resources efficiently and the government should intervene to increase social welfare.

Note: Students may also explain imperfect information leading to over allocation of resources, such as in the cigarettes market.

Conclusion:

Since public goods and imperfect information both cause the market to fail, government intervention would be required to maximize social welfare.

(b) Evaluate the alternative policies that are adopted by the Singapore government [15] to correct for both these types of market failure.

Question Analysis:

Command word	-	Evaluate: students are to explain the various policies used as well as their limitations, and make a judgement based on a chosen criteria.								
Content	-	Market failure analysis using cost/benefit diagram Policies to correct market failure								
Context	-	None given, students can use any examples from their own knowledge								

Introduction

Market failure occurs in the case of public goods and when information is not perfect as free market does not allocate resources efficiently. Hence government intervention is needed in the market for public goods and in situations where information is imperfect.

Requirement 1: Direct provision for missing markets

- Singapore government could take on the role of provision of such public goods and finances them through taxation. The government can tax the population and earn tax revenue, which can then be used to provide public goods. For example, in the case of national defence, the Singapore government takes on the responsibility of providing national defence to the people within the country.
- Alternatively, Singapore government could also pay private firms to provide public goods to the public. In the case of street lightings, Singapore government agencies such as Land Transport Authority (LTA), National Parks (NParks) and Housing Development Board (HDB) engage contractors to build street lamps and manage the lightings within their purview.
- Through direct provision, the government is able to provide the good at the socially optimal quantity, thus maximizing social welfare.

Limitations of direct provision:

Opportunity cost incurred:

- In direct provision of public goods such as street lightings, government will finance the goods collectively through tax revenue collected. However Singapore government has to be cautious in financing different public projects given the limited tax revenue.
- If more is spend on the production of public goods, an opportunity cost is incurred as less could be spent in other areas such as education and healthcare. Thus Singapore government has to weigh the cost and benefits of producing additional unit of public goods given the needs of aging population in Singapore.

Overprovision of public goods:

- Due to the non-rejectable nature of public goods, consumers cannot choose not to consume it once it has been provided for.
- Governments also have imperfect knowledge on what the socially optimal quantity of the product should be.
- Thus, the government may end up provided too much of certain public goods. For example, they may install streetlights in areas with very little footfall.
- There would be a wastage of resources and a deadweight loss incurred by society.

Requirement 2: Public education

- When information is not perfect, government may step in to ensure that relevant information is provided to the public. Public may not have complete information on the impacts of consuming merits and demerit goods. Hence Singapore government uses <u>campaigns to educate</u> the public about the possible impacts of consuming and/or producing the goods.
- In the case of vaccines, the government can use campaigns, advertisements and commercials to explain the full benefits of getting vaccinated, such as being protected against certain illnesses. For example, the Health Promotion Board in Singapore disseminates information on the benefits of taking vaccinations to reduce chances of cervical cancer.
- Such campaigns increase the perceived MPB of consuming the vaccine, so that perceived MPB = actual MPB. Thus, consumers will be able to make rational decisions by consuming at actual MPB = actual MPC in order to maximize their utility.

Market for Vaccinations



• This will help to increase the consumption of vaccines to the socially optimal quantity and maximize social welfare, thus correcting market failure.

Strengths and limitations of public education:

• Government provision of information is likely to be more reliable and hence more effective in helping consumers make rational decision. It is therefore beneficial to have

a neutral party and thus government's involvement in the provision of information.

- However time and money is spent by the government to obtain the relevant information before they can release the information to the public. There is a cost incurred by the government.
- Furthermore if Singapore government were to provide information on the quality of goods, the government must decide on what type of goods they should provide information on. Given limited resources, it is impossible for the government to provide information on the quality for all type of goods in Singapore. Singapore government is likely to provide information on the quality of food products, drugs, electronics and beauty products, goods that affect consumers' health and safety. However, the goods that call for government provision of information may change over time and constant review is needed. Therefore government plays a huge role in correcting imperfect information. However this puts a lot of burden and strain on government resources.
- Therefore Singapore government can consider the alternative approach to correct imperfect information. This alternative policy place the responsibility of providing information on the quality of goods on the hands of the producers.

Requirement 3: Lemon law (optional, students only need to explain 2 requirements in their answer)

- Instead of government providing information directly, Singapore government also adopted alternative approach to prevent imperfect information in the market. Singapore government passed laws to ensure that producers themselves provide accurate information to the consumers to ensure that consumers make rational decisions and consume at the socially optimum level.
- Singapore government passed a Lemon Law to protect the consumers from imperfect information on the quality of the goods. For example the goods may not meet standards of quality and performance, especially after repeated repair. Hence such laws obligate sellers to repair, replace, or refund or reduce the price of those defective goods. The law covers all general consumer products purchased in Singapore such stationery, apparel, electronics, bedding, and big-ticket items such as motorcycles and cars. In the case of second hand cars, the Lemon Law deters car dealers from providing any inaccurate information and ensures the quality of second-hand cars consumers received is as stated by the car dealers. Should the quality not match the information given, consumers are entitled to repair, replace, refund or reduce price for the cars.

Overall Evaluation:

- There are various tools which government can use to correct the market failure in the case of public goods and when information is imperfect. Each policy has its own strengths and limitations. Thus alternative policies could be proposed so help correct the market failure.
- Criteria: The importance of the policies used depends on the extent of market failure
 - In the case of public goods, there is a large extent of market failure due to the missing markets.
 - Thus, even though there are limitations and constraints faced in direct provision, the government should still intervene for essential public goods such as street lights. Even if the government over provides the goods, it is still a better outcome than a missing market.
 - In contrast, for the case of imperfect information, there is only a partial market failure. Government intervention through public education may not be as important as direct provision of public goods.
 - This is especially true for societies that are more educated and with the advancements in technology that have made information more readily available to consumers.

• Thus, while the government should still intervene, the extent of intervention would be lower compared to public goods.

Note to students: For this question, much of the evaluation would be in the body paragraphs. It is more difficult to write an overall evaluation since there are 2 different sources of market failure that are being addressed by the policies.

- **7.** All residents in the United Kingdom (UK) are automatically entitled to free public healthcare through the National Health Service. On the other hand, Singapore adopts a universal healthcare coverage through a mixed financing system with individual payments and subsidies from the government.
 - (a) Explain why a government intervenes in the market for healthcare. [10]

Question Analysis:

Command word	- Explain: students are to elaborate on the causal links between a						
	cause and effect. For this question,						
	 Cause (start) = consumption of healthcare 						
	- Effect (end) = market failure, government needs to intervene						
Content	Market failure analysis using cost/benefit diagram						
	- Sources of market failure: positive externalities and imperfect						
	information.						
Context	Market for healthcare						
	Decision making by consumers of healthcare						

Suggested answer for Part (a)

Introduction:

- Healthcare is a merit good which generates positive externalities and is deemed by the government to be socially desirable for consumption.
- When left to the free market, people will under-consume healthcare due to the presence of positive externalities and imperfect information. Thus, market failure arises and a government intervenes in the healthcare market to achieve allocative efficiency and equity.

Body:

Requirement 1: Consumption of healthcare leads to market failure due to positive externalities

- In the pursuit of self-interest, individuals will only consider their own private costs and benefits and consume at Q_M units, where Marginal Private Cost (MPC) = Marginal Private Benefit (MPB).
 - MPC: the cost of healthcare such as consultations with a doctor
 - MPB: the benefits of better health such as being able to go to work and earn an income.
- However, there are external benefits to society as healthcare enables individuals to become healthier and this may lead to greater labour productivity. Third parties such as firms benefit from a more productive workforce as more real output is produced with a given amount of labour, allowing firms to earn higher profits.
- The presence of Marginal External Benefit (MEB) creates a divergence between the MPB and marginal social benefits (MSB) where MSB= MPB + MEB. Thus MSB > MPB as shown in the diagram below.
- Assuming no negative externality, MPC equals to marginal social cost MSC.
- The socially optimum output level is Q_M units, where MSB=MSC.
- Thus, there is an under-consumption of Q_MQ_S units. For every unit consumed from Q_M to Q_S, the MSB is greater than MSC, which means that society could benefit from increased consumption. There is a deadweight loss of area ABC and allocative inefficiency.
- Thus, the free market fails and government intervention is necessary to address the allocative inefficiency in the healthcare market.



Requirement 2: Imperfect information in healthcare leads to market failure.

- If left to the free market, it is likely that healthcare will be under-consumed because individuals undervalue their private benefits from the consumption of it.
- Consumers may be unaware of the full benefits of healthcare services and underestimate the benefits that they would receive by identifying their illnesses early. For example, a young adult in their 20s may think that they are fit and healthy and do not need to spend on health check-ups. However, they are unaware that they have underlying conditions that go undetected, and could have benefited greatly from health check-ups.



- With reference to Figure 2, due to imperfect information, there is a divergence between MPB (perceived) and MPB (actual). When consumers undervalue the benefits of consuming healthcare, they will consume at Q_M units, where MPB (perceived) = MPC.
- However, if the consumers have perfect knowledge, they would consume at a higher output, Q_s, where MPB (actual) = MPC.
- Hence, with imperfect information, there will be an under-consumption of Q_MQ_S units. For every unit consumed from Q_M to Q_S, MPB > MPC and consumers could benefit from more consumption of healthcare. Therefore, there is a deadweight loss represented by area ABC.

Optional: Explain equity concerns in the healthcare market which is a reason for government intervention

- Equity is the fairness in the distribution of economic welfare such as the access to essential goods and services like healthcare services.
- The high price of healthcare, especially for secondary healthcare since it involves hospital bills, means that it may not be affordable to the lower income groups, resulting in greater inequity.

Conclusion:

• Hence, a government intervenes in the healthcare market to attain allocative efficiency and equity.

(b)	Assess the economic case for the different approaches between the UK and	[15]
	Singapore governments in their healthcare markets.	

Question Analysis:

Command word	- Assess: students are to explain the approaches used by the UK and Singapore as well as their limitations, and make a judgement based on a chosen criteria.
Content	- Market failure analysis using cost/benefit diagram
	- Policies to correct market failure
Context	- Market for healthcare
	- UK and Singapore

Suggested answer for part (b)

Introduction:

- A government objective is to maximise society's welfare. Due to the allocative inefficiency and inequity issues present in the healthcare market as explained in (a), a government intervenes in the healthcare market to achieve allocative efficiency and equity.
- Since there is under-consumption of healthcare in society, both the UK and Singapore governments aim to increase consumption to the socially optional quantity. This can be done through various policies to lower the MPC of consumption.
- The different approaches by the UK and Singapore governments in their healthcare markets can be justified based on the different levels of perception of marginal external benefits (MEB) and the different approaches to attain equity in their healthcare markets.
- However, there are also economic arguments against the approaches adopted by the UK and Singapore governments.

Body:

Requirement 1: Explain the economic case for UK in providing free healthcare

- a. The MEB for UK is greater than that for Singapore
 - The UK government may value or perceive the MEB of healthcare to be greater than that of Singapore in the healthcare market.
 - With reference to the graph below, the socially optimum level of consumption is where MSB=MSC at Q_S units. If left to the free market, the level of consumption would be where MPB = MPC at Q_M.
 - The level of under-consumption would be Q_S minus Q_M units. Due to the high MEB, there is a large divergence between MPB and MSB, and a resulting greater level of under-consumption.
 - To achieve allocative efficiency where MSB= MSC at Q_s , this is the level where MPB = 0.
 - If the UK government gives free healthcare (i.e. full subsidy), the MPC curve shifts to MPC + subsidy. The full subsidy allows the consumers to internalise the positive externality. The new level of consumption would be where MPC + full subsidy = MPB which is the socially optimal level of consumption Q_S.



- Thus social welfare is maximised and the UK government's approach is justified.
- b. Equity addressed differently by the UK government
 - Healthcare services provided by the National Health Service (NHS) are free of charge to all residents in UK and one of the reasons is because of equity. Providing free healthcare helps to ensure that all residents in the UK are able to access healthcare services, regardless of their income levels and ability to afford healthcare.

Evaluation: Economic arguments against providing free healthcare in the UK

- a. Greater strain on government budget position and greater national debt
 - Providing free healthcare for UK's large resident population imposes a greater strain on the UK government's budget as it has to be financed using taxpayers' monies. Assuming the UK government has no national reserves, if it runs a budget deficit due to its high expenditure on free healthcare, this adds on to its national debt and worsens it.
- b. High opportunity cost incurred
 - In addition, the high government funding used for free healthcare imposes a high opportunity cost. This may be in the form of foregone government expenditure on developing its infrastructure by improving its transportation network.
- c. Moral hazard issues due to free provision.
 - Given that NHS healthcare services are provided for free, this may partially insulate the UK residents from the full costs of healthcare services, thus resulting in possible moral hazard. UK residents may take less care of their general health in consideration of their access to free basic healthcare services or they may undertake riskier activities such as parkour. This could lead to long queues and waiting times for healthcare services which may result in a decline in healthcare standards in UK.

Requirement 2: Explain the economic case for Singapore in providing subsidies but not free healthcare

- a. MEB for Singapore is lower than that for the UK
 - As explained earlier, the MEB for healthcare may be valued or perceived to be lower in Singapore than the UK. If the government provides a full subsidy, this would lead to an overconsumption of healthcare beyond Q_S. Thus, the Singapore government chooses not to provide free healthcare.
 - In order attain the socially optimum output level at Qs where MSC=MSB, the Singapore government chooses to provide an indirect subsidy that is equal to Singapore's MEB. This reduces MPC, shifting it to MPC + subsidy and this intersects MPB at Qs which is allocative efficient.



- Socially welfare is therefore maximised with a partial subsidy.
- b. Equity addressed differently by the Singapore government
 - If a low income individual is still having trouble paying for his medical bills after indirect subsidies given by the government, the government may provide even more subsidies through Medifund. This is done through means testing the lower income individual and his family.
 - By giving different amounts of subsidy based on individual income levels, the government is able to ensure the accessibility of healthcare for all households without overburdening the budget.
- c. Addressing moral hazard issue that will be present if healthcare is provided for free
 - By learning from the economic argument against UK's free provision of healthcare, the Singapore government believes in the mixed financing scheme as it promotes individual responsibility and reduces the moral hazard issue.

Economic arguments against giving subsidy for Singapore

- a. Difficulty in measuring MEB which may lead to government failure
 - There are difficulties in measuring the exact value of the MEB due to imperfect information. In this context, it is difficult to place an exact monetary value on the productivity gains to an economy from a healthier workforce due to the difficulty in isolating the causality effect. Hence, the exact amount of subsidy to be given may be overestimated or underestimated.

Evaluation/Conclusion:

- The different approaches arise because of the different valuations of MEB (MEB for UK > MEB for SG) and the different ways to address equity. Whether the economic case is justifiable for UK or Singapore depends on the sustainability of the approach. In addition, it also depends on priority of the government.
- Criteria 1: Sustainability
 - In reality, Singapore has a healthier budget than the UK. With prudent use of government funds and the shared responsibility for healthcare expenditure, Singapore has been able to accumulate more reserves. On the other hand, having a welfare system has strained the UK government's budget over time.
 - Thus, Singapore's approach might be more justified than the UK's. It is more sustainable in the long run, and enables the government to build up emergency reserves which could improve healthcare in the long run. For example, in unexpected pandemics like COVID-19, the government will be able to spend on vaccinations, masks, and other essential healthcare products and services.
- Criteria 2: Priority of the government
 - Governments have many goals, and will experience trade-offs between these objectives in their decision making.

- One trade off could be between efficiency and equity.
- Have a full subsidy ensures equity, since healthcare is made accessible to all households regardless of their income. While Singapore provides additional subsidies to lower income households, this may not always be sufficient and there may be middle income households that are left out and struggle with high healthcare costs.
- On the other hand, a full subsidy is more likely to reduce efficiency. The moral hazard issue is very likely to materialise, and there are often long queues and waits for public healthcare services in the UK.
- The UK government prioritises equity over efficiency, and this justifies their use of a full subsidy. However, the Singapore government prioritises efficiency, and this justifies their choice of provided a partial subsidy and focusing on shared responsibility instead.

Optional Essay Question:

Note: 8a was covered in the Central Economic Problem tutorial. 8b is a Market Failure question.

- 8. Prospective students and governments each make decisions that affect the scarce resources that are devoted to university education.
 - (a) Explain the determinants of a rational prospective student's decision on [10] whether to participate in university education.

(b)	Discuss	the	factors	that	governments	should	consider	in	allocating	
	resources to university education.								[15]	

(A-level 2015)

Suggested answer for part (b)

Question Analysis:

Command word	- Discuss: students are to explain the different factors the
	government considers in decision making, and make a judgement
	of these factors based on a chosen criteria.
Content	- Decision making framework
	- Market failure analysis using cost/benefit diagram
	- Policies to correct market failure
Context	- Market for university education

<u>Approach</u>

- This question requires an analysis of the government's decision making. Students may choose to use the decision making model to frame their answers.
- In order to have a thorough and analytical answer, students must explain the various sources of market failure present, as these determine the extent of government intervention needed.

Note: This is not a question on how to or policies to encourage university education! It is about examining the factors to be considered in how much resources should be allocated to this segment of education.

Introduction

- Governments' policy making in resource allocation has to necessarily consider the **outcomes from society's point of view** because resources under their care are collectively owned by the population, eg. through tax revenue collected. These considerations will factor in effects on society which in market-based decisions by individuals and firms will be omitted.
- When individuals obtain university education, there are **external benefits on others but this will not be considered** because the individuals do not know the true value or simply because these effects do not matter to them.
- The presence of positive externality, imperfect information and the issue of fair access to the population are among key factors to be considered.
- University education is generally considered to be a **merit good**, one which a government will likely believe to be under-produced and under-consumed without government intervention. Governments tend to financially support the provision of university education,

hence the issue of how much resources to allocate. The greater the extent of subsidy, the more the resources needed for this use.

 Most people agree that the government should intervene in the provision of university education, but disagree as to how much resources should be allocated based on varying factors.

Requirement 1: Benefits of government intervention

Topic sentence: The first factor to be considered is the benefits of government intervention.

- In the market for university education, there are two sources of market failure: positive externalities and imperfect information. There may also be inequity in the distribution of resources.
- Thus, the benefit of government intervention is that market failure can be corrected and society's welfare can be increased.

Note: Students can choose 2 out of the 3 reasons for government intervention below:

Positive externalities from consumption of university education

- The consumption of university education results in positive externalities/external benefits that are not considered by prospective students. External benefits include the benefits in economic growth arising from more qualified labour force. Such economic growth could generate income and jobs for third parties, such as people who did not attend university.
- As explained in part (a), prospective students only consider their marginal private costs and benefits, and consume at Q_M in the diagram below to maximise their utility.
- However, the presence of external benefits results in MSB being greater than MPB. The socially optimal equilibrium is where MSB = MSC, at quantity Q_s.
- Therefore there is an under consumption of university education, leading to a welfare loss, and the government can intervene to increase consumption.



- <u>Evaluation</u>: The extent of government intervention depends on the extent of external benefit. For example, if the government is providing a subsidy, the subsidy should be equal to the value of the external benefit at Q_s.
- The extent of external benefit and appropriate amount of resources for subsidy will vary between different courses of studies. For example, the external benefit for medicine course for example could be deemed larger than that for engineering.

• Note to students: Do not overly focus on explaining the various policies to correct market failure, as that is not the focus of this question.

• Evaluation:

- **However, there is a lack of perfect knowledge** in the true value of the positive externality of every course as much of this is based on estimates of future values to the economy, leading to the problem of under or over allocation of resources. A course could be considered to have low positive externality presently but with changes in economic and job landscapes such a course could be highly valued in the future.
- There is need to involve the private sector more in the provision of higher education. Increasingly it has become more attractive for private firms to leverage universities in conducting research for eventual commercial applications. It is also to the interest of innovation-driven firms to support the growth of universities as a way to nurture talents to develop their future commercial viability. By enlisting private sector's support, less of public resources will be needed for universities without sacrificing the growth of future talents.

Imperfect information in the consumption of university education:

- There are many aspects of information which prospective students may not have, such as true cost of the education, the expected earnings of courses, job needs and prospects of the economy.
- For example, some prospective students may underestimate the benefits of enrolling into certain university courses. This could be because they are unaware about which industries are currently growing and are likely to contribute more to the economy in the future. Thus, they do not realise that studying this course could give them better job prospects in the future.
- Since the MPB is underestimated, prospective students will under consume university education, especially in some courses.
- With the imperfect information, the government may have to give more financial support for courses which are not popular but deemed necessary for the economy in the future.
- Evaluation:
 - In this 21st century, the job market is fast changing due to technological disruptions and jobs of the future are unknown. Governments may not be able to correctly predict the changing economy, so may not be able to allocate its funding on university education accurately.
 - There is thus an issue on the extent of resources to be allocated for new courses or courses which do not seem to meet the needs of the economy in present and medium terms.

Reducing inequity:

- University education helps in improving **economic mobility** of low income households however few could afford the high university fees.
- Subsidising based on the amount of positive externality may not provide fair access for all students and deprive able students from the lower income group who may not be able to afford the course fees for such courses. Hence the need for the government to allocate funds for schemes to help the low income students.
- Evaluation:
 - Having to take up loan to finance university education → lowers the net private benefit of university education as part of their future incomes will be used to repay their loans →deterring low income students. Hence providing cheap loans to these

students may not be the optimal decision to achieve efficient allocating of resources

 Using objective criteria such as academic ability and means-testing based on household earnings will lead to a more efficient allocation of resources for university education.

Requirement 2: Costs and constraints faced

[Note: Students can consider the limitations of policies such as subsidies, even though the policy has not been explained in detail in previous paragraphs.]

- Government should consider the funds it has available for university education. There
 is also opportunity cost involved in directing funds to universities. Trade-offs will have to
 be made between spending large amounts on university education of some selected
 students and spending on pre-school and primary school, considering that the extent of
 external benefit of pre-school education is much higher and more broad-based than
 university education.
- Also need to consider the government's budget position. Government spending on financing student's university education can cause a **strain on the government's budget**, especially for debt-ridden countries with pressing needs to adopt austerity measures to reduce their debt.
- Government may face constraints in information available. They might not be able to estimate the extent of market failure accurately and thus may not allocate the right amount of resources to university education.
- Evaluation: University education is a form of labour investment. Cutting government spending on university education will generate welfare loss in the form of lower future economic growth. It may lead to severe shortage of labour skills in future growth industries. Under–investing in university education will slow down innovation and technological development → will lead to lower productive capacity and economic growth in the long run, and leading to generally lower quality of life.

Synthesis

- University education is key to a country **sharpening its growth capacity and international competitiveness** via the quality of labour force and innovation. It is an area of spending that is justifiable economically speaking.
- The issue of to what extent resources should be directed, to university education as compared to lower or other areas of education and to the alternative university courses, has to be considered against the relative extents of external benefit in comparison to private benefit. Where external benefit is a much bigger ratio than private benefit, a larger amount of resources is needed if this is a needed area of skills for the economy.
- It is however necessary for the government to ensure that prospective students who cannot afford the standard subsidised fees be given extra help through **financial aid**.
- Ultimately, the deciding factor will be the government's affordability for funding. Governments with debt problems will have to seek ways to involve the private sector in supporting university education, for example through collaboration that enables universities to provide research support for areas of innovation that can be applied and marketed by private firms.