H2 ECONOMICS – PROMOTIONAL EXAM 2021 QP

Case Study Question: Developments in the global semiconductor industry

Extract 1: The smallest things leave the biggest impact

Semiconductors, also known as microchips and integrated circuits, are essential components in every electronics product, whether it be a simple remote control unit for changing channels on the television, or car electronics systems like driver assistance and navigation. However, recent events have caused significant disruption to the industry and excess demand in the market for semiconductors.

The supply of microchips cannot be turned on and off with a switch. Multibillion-dollar fabrication plants are finely tuned and run 24/7, 365 days a year. Changing the production line for a new microchip can take weeks, if not months, and adding significant new fabrication capacity can take years and billions of dollars.

When car sales bounced back faster than expected in the third quarter last year and carmakers tried to ramp up production again, microchip factories could not respond fast enough given the long lead times needed to schedule orders. Other industries, such as consumer electronics and home appliances, saw a spike in sales from the pandemic's "stay at home" effect but suddenly found themselves unable to secure adequate supplies of microchips to meet the increased demand.

A fire at a Renesas microchip fabrication plant in Japan, which accounts for 30 per cent of the global market for microchips used in cars, as well as disruptions to microchips plants following the severe winter in Texas, further compounded the excess demand. Taiwan also faced the worst drought in nearly 60 years, threatening chip-making production lines that consume large amounts of water.

Source: Adapted from *South China Morning Post*, 12 May 2021 and *Nikkei Asia*, 28 April 2021

Extract 2: Growth in semiconductors exports for Singapore and South Korea

As consumption slowly returns to life across the world with growing vaccination rates and government stimulus payments reaching buyers, impacts are being felt around the world. Analysts are predicting higher full-year exports for Singapore after a better-than-expected first quarter showing. Electronics shipments expanded 24.4 per cent from a year ago in March. Selena Ling from OCBC Bank noted that there was double-digit growth recorded in personal computers, electronic components and integrated circuits shipments. "This is a clear indication that Singapore's semiconductor industry is benefiting from the ongoing global shortage," she said.

South Korea's exports in April rose the most in ten years – total semiconductor shipments climbed 30.2 per cent, while automobiles exports jumped 73.4 per cent. Products such as computers, televisions and smartphones have been rising in demand along with semiconductors.

Source: *The Straits Times*, 16 April 2021 and *Bloomberg*, 1 May 2021

Table 1: Composition of Gross Domestic Product (GDP) for Singapore and South Korea

As % of GDP (2020)	Singapore	South Korea
Consumption Expenditure	45	65
Investment Expenditure	23	32
Export Revenue	176	37
Import Expenditure	144	33

Source: World Bank

Extract 3: Dirty microchips

With the increasing demand for high-tech devices such as smart phones, wearable watches and portable health monitoring devices, the semiconductor manufacturing industry faces a big challenge of fabricating these devices in a sustainable and cost-effective way.

The current semiconductor manufacturing process releases a large amount of hazardous chemical waste in the fabrication process, which poses a great threat to human beings (e.g. toxic chemicals may contain carcinogens) and the environment (e.g. resulting in water and air pollution). It takes three to four months for a disc of silicon to go through the multiple stages required to process them into the finished product. Rinsing with huge amounts of ultrapure water is a key step of the process. With each new generation, more electricity and water are required, and more greenhouse gases are emitted.

Source: Adapted from *Oxford News Blog*, 4 May 2021 and *Bloomberg Green*, 8 April 2021

Extract 4: Measures targeting air pollution from semiconductor production

In Taiwan, the "Air Pollution Control and Emissions Standards for the Semiconductor Industry" law spells out limits on various pollutants that apply specifically to the semiconductor manufacturing industry. To comply with regulatory emissions standards, Taiwan Semiconductor Manufacturing Company (TSMC) last year spent around US$667 million on environmental protection measures, while over the last seven years, it has invested some US$3.38 billion to reduce its impact on the environment.

From 2019, large emitters in Singapore have to pay to pollute when the government rolls out a carbon tax scheme. A carbon tax puts a price on pollution. In Singapore, the 30 to 40 large emitters - mainly from the petroleum refining, chemical and semiconductor sectors - will pay up to S$15 per tonne of emissions by 2030. The Singapore government expects to collect carbon tax revenue of about S$1 billion in the first five years, which can be channelled to projects that deliver emissions reduction. To provide businesses with certainty in the current challenging economic climate, the carbon tax rate will be maintained at S$5 per tonne of greenhouse gas emissions up until 2023. An appropriate carbon tax level is one of the key levers to spur the reduction of Singapore's carbon footprint, promote industry innovation and green growth while maintaining Singapore's overall economic competitiveness.

Since 2015, South Korea has implemented the Korea Emissions Trading Scheme, which aims to mitigate greenhouse gas emissions using a market-based instrument. This scheme caps emissions from participants, including semiconductor producers, and involves the issuance of a corresponding number of emissions allowances which can be traded among participants. The emission permit price, which started at 8,640 won per tonne in 2015, constantly rose and reached 42,500 won in April 2020. That represented a 392 per cent rise since the scheme started. "What companies want most at the moment is the stability of permit prices in the market," said Lee Chung-kuk from the Korea Research Institute on Climate Change.

Source: Various sources

Questions

(a) With reference to Extract 1, explain the likely value of the price elasticity of supply for semiconductors. [2]

(b) Using Extract 1 and a diagram, account for the excess demand for semiconductors. [4]

(c) **(i)** Define Gross Domestic Product (GDP). [1]

(ii) Both Singapore and South Korea saw strong growth in exports of semiconductors.

Discuss how rising export revenue may have different impacts on the GDP of these two countries. [8]

(d) **(i)** With the aid of a diagram, explain why there is allocative inefficiency in the market for semiconductors. [5]

(ii) Discuss the measures raised in Extract 4 that a government could adopt to address the allocative inefficiency in the semiconductor industry. [10]

[Total: 30]

Essay Questions

Answer **TWO** questions in total.

Question 1

Increasing environmental consciousness has led to growing interest in electric vehicles. At the same time, technological advancement in battery production methods has contributed positively to the growth of the global electric vehicle market. The battery pack is the single most expensive part of an electric vehicle, accounting for about 30 per cent of the total cost.

(a) Using relevant examples, distinguish between the concepts of price elasticity of demand and cross-price elasticity of demand. [10]

(b) Discuss the likely impact of the above events on the total revenue earned by producers of electric vehicles and conventional fuel-powered vehicles. [15]

Question 2

Singapore's healthcare system has evolved significantly in the last decade. There has been increasing focus on preventive healthcare to reduce the likelihood of future health complications, as well as to ensure our economic vibrancy. Amongst a slew of measures to encourage the consumption of healthcare, substantial subsidies are provided across a wide range of healthcare services.

Source: Adapted from *TODAYonline.com*, 2 January 2020

(a) Explain how market failure arises in the consumption of healthcare services. [10]

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

Question 3

In 2020, investment in fixed capital formation in Singapore totalled S$100.9 billion, making up 21.5% of GDP.

Source: SingStat

(a) Using AD-AS analysis, explain how a rise in investment expenditure can bring about economic growth in an economy. [10]

(b) Discuss whether economic growth will always lead to a higher standard of living for residents of a country. [15]

H2 ECONOMICS – PROMOTIONAL EXAM 2021
SUGGESTED ANSWERS, MARK SCHEMES & MARKERS' COMMENTS

Case Study Question Suggested Answers

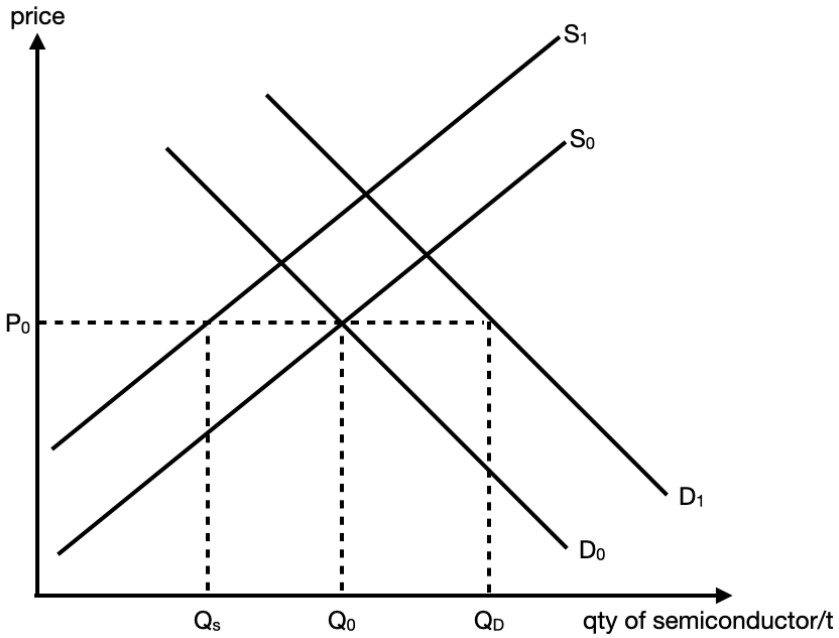
(a)		**With reference to Extract 1, explain the likely value of the price elasticity of supply for semiconductors.** The value of PES is between 0 and 1. [1] 'Adding significant new fabrication capacity and take years and billions of dollars (Ext 1, Para 1) tells us that producers of semiconductors are unable to increase the quantity supplied of semiconductors readily in response to an increase in price. [1] **Markers' Comments** <u>Content</u> ● Distinguishing between quantity supplied and supply is still loose and incorrect for weaker responses. ● Loose/Inaccurate phrasing: o PES is a technical economics concept, and so accurate economics terms should be used. For e.g., it is not sufficient to say *"production cannot increase easily"*, instead answers should state that quantity supplied rises less than proportionately in response to a rise in price. o Many answers gave vague descriptors like a <u>change</u> in price leads to a less than proportionate <u>change</u> in quantity supplied - does change mean rise or fall? Such answers do not show that the student knows the relationship between price and quantity supplied; <u>direction of change</u> is important. o The correct term to use is 'supply is **price** inelastic,' not 'supply is inelastic.' ● There were a handful of answers that confused the PES and PED factors (i.e. lack of close substitutes, therefore supply is price inelastic). This is also evident when students quoted that semiconductors are an "essential component in every electronics product" - this is saying there are no close substitutes for microchips, and does not say anything about PES. <u>Skills</u> ● When the question asks for the 'value', answers should explicitly bring out the numerical value. ● Students have a tendency to lift and quote from the case extensively. This brings little value to the answer. Rather, students should apply the factors to the case material to demonstrate an understanding and application of the theory.	**[2]**
(b)		**Using Extract 1 and a diagram, account for the excess demand for semiconductors.** **<u>Explain rise in demand [1]</u>** The rise in demand for cars and consumer electronics (Ext 1, Para 3) resulted in a rise in derived demand for semiconductors as semiconductors are factors of production used in the manufacturing of cars and consumer electronics.	[4]

Explain fall in supply [1]

The fire in Japan and severe winter in Texas (Ext 1, Para 4) caused a fall in supply as suppliers are less able to produce at every price level, causing a fall in supply of semiconductors.

Explain disequilibrium with diagram [2]

With a rise in demand from D_0 to D_1 and fall in supply from S_0 to S_1, there will be excess demand of Q_SQ_D at the initial equilibrium price of P_0, as quantity demanded Q_D is greater than quantity supplied Q_S.

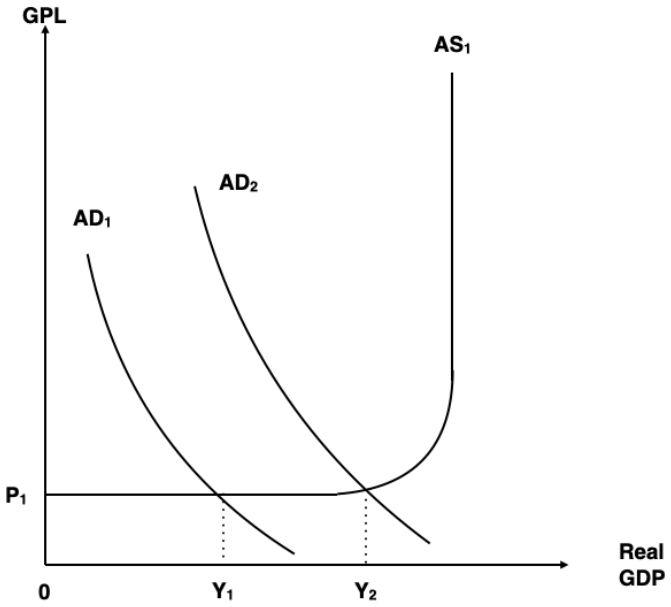


Markers' Comments

Content

- Poor attempted responses did not unpack and interpret 'excess demand' as a shortage in the semiconductor market. This led to answers that were incomplete.
- Some students have a misunderstanding of complements versus factor inputs. Factor inputs are used to produce another good. Complements are not used to produce other goods, but instead are consumed together with another good (e.g. coffee and sugar).
- Shortage must be identified at the initial price level where Qd exceeds Qs, because at other price levels there may not be a shortage.
- The question asked to account for why excess demand (shortage) results, not to explain what happened to equilibrium price and quantity. Hence, explanation of the price adjustment process to clear the shortage is not needed for this question. Furthermore, justification of whether supply or demand shifted more was also unnecessary since both would contribute to a shortage, and students penalised themselves in terms of time.
- PED and PES are not needed in this question. PED and PES help to explain the responsiveness of Qd and Qs during the adjustment process. This question does not require explanation of the adjustment process, answers only need to link to why a shortage results.

		• Some students are still making basic conceptual errors like a rise in demand would lead to a rise in supply of semiconductors. A rise in demand leads to price rising, and hence an increase in quantity supplied. Skills • Lifting from or directly quoting the extracts is not a form of explanation. students need to make an analytical link to the non-price factor to account for the direction of shift of both demand and supply curves. For example, the explanation for the fall in SS should be link to a fall in the number of producers or a rise in marginal cost of production due to 'fire in Japan and the severe winter' • A handful of answers only accounted for the shift in demand. This shows a poor appreciation of the extract. Students should appreciate the extract in its entirety. • The question is about semiconductors, but several students went on to answer on consumer electronics with no link made to semiconductors or not even realising semiconductors are NOT consumer electronics. Students must be sensitive to what market the question is asking for. • The diagram needs to be **well-labelled and referenced** for it to be meaningful to the answer. Otherwise, there is little value in drawing one.	
(c)	**(i)**	**Define Gross Domestic Product (GDP).** GDP refers to the value of all final goods and services produced by factors of production located within the geographical boundaries of a country, within a period of time. [1] **Markers' Comments** Content • The 'P' in GDP refers to 'Product' - this means it refers to the value of final goods & services produced, not consumed or income earned. National product and national income are not the same thing, they just have the same value as whatever is produced is sold and income is earned. • Similarly, GDP does not merely refer to the level of output produced. • There were many loose attempts at defining this key concept. Weak responses lacked precision regarding the time period of the GDP definition. • "Value of final goods and services" and "final value of goods and services" mean two different things. The latter is incorrect. • Some attempted to 'define' the indicator through its use to show SOL changes. This demonstrated a poor understanding of the question and content. • Most responses which scored 0 missed out the keywords "final" and/or "over a period of time".	[1]

	(ii)	**Both Singapore and South Korea saw strong growth in exports of semiconductors.** **Discuss how rising export revenue may have different impacts on the GDP of these two countries.** [P]: The rise in export revenue (X) will lead to the rise in Singapore's and South Korea's real GDP. [E+E]: The rise in (X) leads to rise in AD, assuming import expenditure remains unchanged. This rise in AD will result in unplanned fall in inventory levels, causing firms to increase production, increasing hiring of FOP. As households receives more factor income for the factor services, they spend a portion of this additional income on domestic goods and services, causing a rise in induced consumption and thus AD. This creates another round of unplanned fall in inventories and the process repeats itself until a new national income equilibrium is achieve.  [L]: Thus, the initial rise in AD will lead to a multiplied rise in real GDP from Y1 to Y2 as shown in the diagram above. [P]: Singapore might experience a greater rise in its GDP than South Korea. [E+E]: Even though both countries saw double digit growth in semiconductor exports (Extract 2), export revenue is more significant to Singapore (Table 1) as it takes up a greater percentage of GDP as compared to South Korea. This is because Singapore has a small domestic market so it is more reliant on exports, whereas South Korea is relatively more dependent on domestic consumption for growth. [L]: Hence, Singapore's AD is expected to shift by a larger extent due to the rise in X and thus a larger rise in GDP than South Korea's. [P]: South Korea might experience a greater rise in its RGDP than Singapore. [E+E]: From Table 1, we can infer that Singapore has a relatively larger MPM (*can consider using consumption expenditure to infer the MPC_D value as well).* Due to her lack of natural resources, Singapore is heavily reliant on imported	[8]

inputs, leading to the high MPM. Hence, Singapore has a relatively smaller multiplier (k) value than South Korea. The larger the MPW, the smaller the size of the multiplier as each round of induced spending on domestically produced goods is smaller and thus the overall rise in real GDP will be small. With a given rise in AD, the rise in Singapore's GDP is expected to be relatively smaller than the rise in GDP of South Korea due to the smaller multiplier effect.

[L]: Hence, South Korea might experience a larger rise in RGDP than Singapore with the rise in export revenue.

Conclusion

[Stand]: The impact on GDP for the 2 countries depends on different factors for each of the country.

[Substantiation]: Singapore can be expected to experience a greater rise in GDP than South Korea. Given the small and open nature of Singapore's economy, there is a high dependency on trade as a source of economic growth. Total trade activities (X+M) accounts for more than 300% of Singapore's GDP. Hence, we can expect the rise in Singapore's GDP from any given rise in trade activities to be significant.

At the same time, we can expect South Korea's multiplier value is larger than Singapore. Hence, given an increase in X, there will be a larger rise in South Korea's GDP.

Knowledge, Application/ Understanding, Analysis		
Levels	**Descriptor**	**Marks**
L2	● Analytical explanation of how the rise in export revenue will affect RGDP. ● Answer addresses how Singapore and South Korea's GDP might increase to different extent, taking into consideration evidence from the case (i.e. size of k, proportion of X to AD, spare capacity)	4 – 6
L1	● Descriptive explanation of how the rise in export revenue will affect RGDP ● Answer is one sided ● Answer contains conceptual errors when using the AD-AS model to explain the impact of RGDP.	1 – 3
E	● Clear stand with substantiation that is based on evidence / context of Singapore and South Korea	1 – 2

Markers' Comments

<u>Content</u>

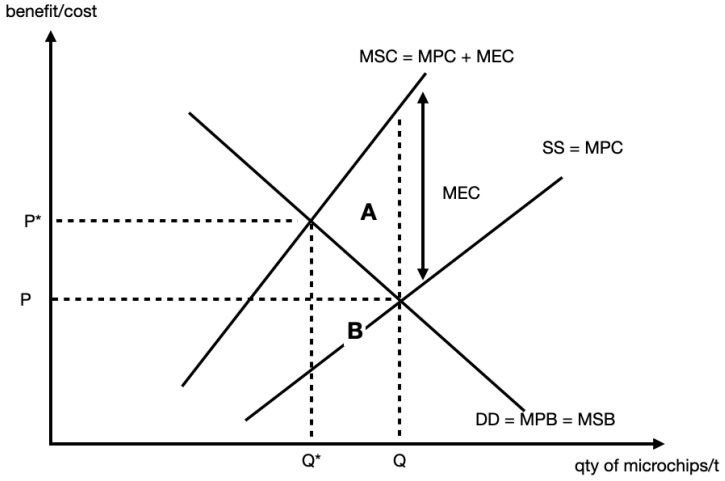
- For some students, there seems to be a mix up between autonomous <u>consumption</u> and autonomous <u>expenditure</u>, saying phrases like "rise in exports leads to a rise in autonomous consumption". C strictly refers to spending by households / consumers only.
- Some students incorrectly explained the rise in exports to directly lead to a rise in income and hence a rise in C, which leads to AD rising. First, it is not explained how a rise in exports leads to a rise in national income. Second, explanations must NEVER start the initial shift in AD from a rise in income, as this leads to induced expenditure rising rather than

autonomous. This shows a weak understanding of the difference between autonomous vs induced expenditure.

- To be precise, "X" in AD refers to export <u>revenue</u>, not just exports. Also, it is export revenue, not export expenditure - exports generate earnings not spending for the country.
- The multiplier effect is applied to GDP change, not AD. E.g. "leads to a multiplied rise in AD" is not accurate, it should be "leads to a multiplied rise in GDP".
- Weak responses misunderstood the data provided in Table 1 (proportion of expenditure to GDP), with the following mistakes:
  - %M of GDP is not equivalent to the MPM of each country. At best, we can only **<u>infer</u>** the MPM from the data.
  - %C of GDP is not the value of MPC or MPCd. Similar to MPM, we can at best only infer from the data. In addition, %C of GDP actually includes both consumer expenditure on domestically produced goods and services **and** international goods and services.
  - It is not necessary to find the arithmetic difference between %X of GDP and %M of GDP. Given the trigger in the question (a rise in X), this is unnecessary. We will assume ceteris paribus and M remains constant.
  - Some tried to calculate a value of (X-M) using the X and M as % of GDP, showing poor understanding of what the data shows
  - The data in Table 1 does not indicate the magnitude of change for each component of AD.
- For closer contextual application (especially since students are expected to know the SG context), answers should explain why SG has a large size of X as % of GDP (because C is small due to a small domestic market), and explain why SG has high MPM (because of reliance on imported inputs).
  - Some answers incorrectly stated that because Singapore lacks natural resources, she is reliant on exports. Or, another error seen was saying that the size of k is dependent on the marginal propensity to export (there's no such thing, anyway).
- Most scripts gave only one factor to analyse the extent of increase in GDP, either size of multiplier (k) or %X out of GDP. A complete answer will require both, and finally an overall synthesis on whether Singapore or South Korea had a larger impact on real GDP.
- It is a common and incorrect assumption that developed economies would operate near/at full employment. It is very much possible for developed economies to be operating with spare capacity, e.g. when unemployment rises during a recession.
- A handful of AD-AS diagrams only labelled the horizontal axis "GDP/t" rather than "real GDP/t". In addition, "Yf" was frequently not labelled. Also, "E" refers to the equilibrium point, it is incorrect to say "GDP rose from E0 to E1".
- Answers often explained that the multiplier process continues until injections equals withdrawals, but there was no mention of injections or withdrawals earlier on in the explanation. Answers should recognise that the rise in injections was the initial rise in X, and that there is an increase in withdrawals with every round of the multiplier process.

<u>Skills</u>

- The question asked for impact on GDP, yet some answers do not explicitly link to GDP or say that GDP rises.
- Where possible, answers should make use of the case evidence. For instance, information on the state of the economy is not provided in the

		case material, hence answers that referred to the state of the economy remained as purely theoretical points. • Some students penalised themselves by writing an excessively long multiplier process (with numerical examples). students need to pay closer attention to the marks allocation to determine the length of their answers. • For "discuss"-type questions, it is always useful to have multiple points of discussion (in this case, >1 factor affecting the extent of increase in GDP), so that a synthesis, with evaluation, can be made at the end of the answer -- this contributes towards evaluation marks. • The question asks for the effects of a rise in exports, hence explanations can start from a rise in exports and there is no need to explain why exports rose. • AD-AS diagrammatic analysis is essential, yet several answers did not have a diagram. Even when there was a diagram drawn, several students drew it in a sloppy manner, with missing/incorrect labels or not making any reference to the diagram at all.	
(d)	**(i)**	**Explain why there is allocative inefficiency in the market for semiconductors.** [P] Left to the free market, there will be overproduction of semiconductors, resulting in market failure. [E+E] Production of semiconductors results in the release of hazardous chemical waste (Ext 3 Para 2), resulting in pollution and threatens the health of human beings who were not involved in the production of semiconductors. This results in an external cost borne by the third parties as they would incur higher medical costs. The presence of this marginal external cost (MEC) results in a divergence between marginal private cost (MPC) and marginal social cost (MSC), where MSC is greater than MPC as it includes MEC. Graphically, the existence of MEC would cost MSC to be higher than MPC, where MEC is the vertical distance between the MSC and MPC curves.  Under the free market, producers will make their decisions based on MPC and disregard MEC. Assuming no positive externalities, MPB = MSB. Producers will produce up till the point where MPC = MPB (DD=SS), resulting in a market equilibrium output of Q.	[5]

However, the socially optimal output is at Q*, where MSB = MSC and societal welfare is maximised. Under the free market, there is an overproduction of semiconductors of Q – Q*. For every unit between Q* and Q, the MSC is greater than the MSB, resulting a deadweight loss of area A as the total social cost of producing Q* to Q (area A+B) is greater than the total societal benefit of producing Q* to Q (area B).

[L] Because of negative externalities, the free market has failed to achieve allocative efficiency as society's welfare is not maximised. The government should thus intervene in the market for semiconductors to improve societal welfare.

1m – evidence of third party effects of negative externality. *Answer should not simply lift from the extract to demonstrate this point.*
1m – shows that MSC > MPC due to MEC
1m – well-labelled diagram
1m – free market equilibrium (DD=SS) vs socially optimal outcome (MSB = MSC)
1m – welfare loss (either TSB – TSC or MSC > MSB for Q* to Q units)

Markers' Comments

Content

- When illustrating market failure, diagrams should have the y-axis labelled as "Cost/Benefit" or "Cost/Benefit/Price" - it is important to recognise that the diagram is showing the cost and benefit curves, and is not simply a demand-supply diagram (with only "Price" as the vertical axis).
- Answers should recognise that the negative externality is generated from **production** rather than **consumption**. Students should learn to distinguish and accurately explain accordingly, whether the externality is generated from consumption or production.
- It is not correct to say that semiconductors are a demerit good. Demerit goods are deemed socially undesirable by the government, and the negative externalities + consumer ignorance arise from the **consumption** of the good/service, which isn't the case for the market for semiconductors.
- Deadweight loss area should be explained and not merely stated.
- A handful referred to the areas in their diagram as "MSC" or "MSB" which is wrong, as it should be "TSC" and "TSB" since they are areas. MSC and MSB is for a particular unit of output and not for a range of output.
- Quite a few students tend to miss out explaining the free market outcome and socially optimal outcome and also the MEC being the divergence between MPC and MSC. These are important steps in the explanation of the market failure arising from externalities or consumer ignorance, and students should be aware and accustomed to this by now.
- When drawing a cost-benefit diagram for society / the market, students should realise that the MPB curve is showing MPB for consumers (based on marginal utility) and the MPC curve is showing MPC for producers (based on marginal cost of production). The MPC for consumers and MPB for producers is actually the market price.
- Students should be mindful whether they are comparing private versus social benefit/cost, and also should not be comparing different things
    - e.g. MPC = MSB is incorrect
    - e.g. MSC > MPB is incorrect
    - e.g. DD intersect MPC is incorrect

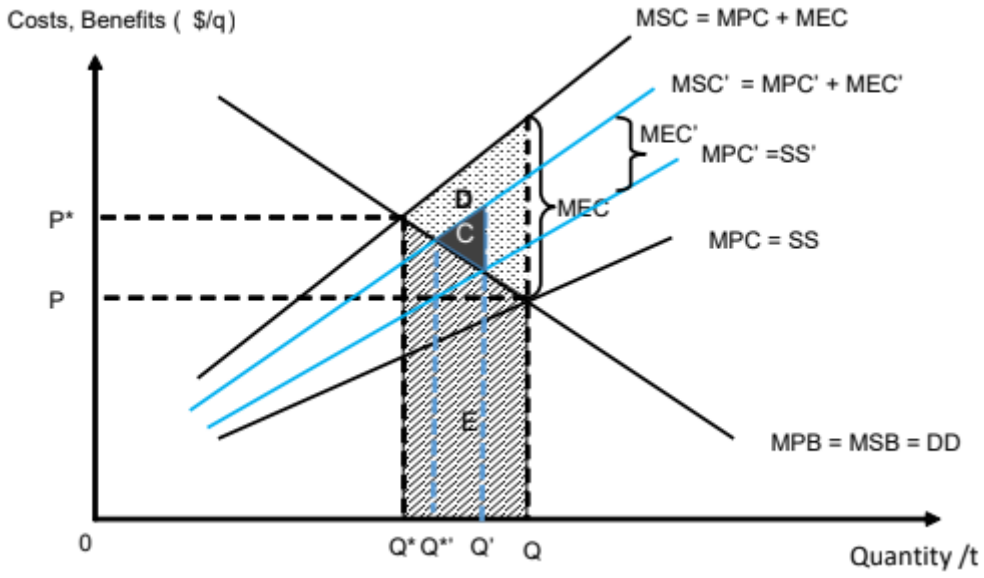
		Skills • Rather than directly lift quotes from the case extracts, students should take the effort to explain what is quoted e.g. what exactly is the external cost and who is the third party involved. • Students should be precise and accurate when making reference to their diagram. For instance, several students referred to curves that were not labelled (e.g. MSB, DD or SS). There were also several students who inaccurately referred to a quantity as "e"; "e" is labelled as an equilibrium point, which is not a quantity. • This is Economics, not Math. Students are expected to write in prose, not with excessive use of Math symbols and equations.	
	(ii)	**Discuss the measures raised in Extract 4 that a government could adopt to address the allocative inefficiency in the semiconductor industry.** ***Approach:*** *Students should explain how at least 2 policies mentioned in Extract 4 can improve allocative efficiency. Thereafter, students can consider either the effectiveness or appropriateness of the policies in addressing the market failure. A strong response will evaluate based on the nature of the market failure and the extent of allocative inefficiency to determine which policy might be more appropriate/effective for the context.* **Introduction** There are 3 measures seen in Extract 4 that was used by Taiwan, Singapore and South Korea to address the air pollution from the production of semiconductors. They are: regulations, carbon tax (pollution tax) and emission trading scheme (tradable permits). **Body –** Measures [P] Regulations on emissions can reduce the amount of pollutants release and hence improve the allocation efficiency in the market. [E+E] When a regulation is imposed such as that in Taiwan (Extract 4, para 1), it compels the firms to take reduce their emission otherwise the firms will face penalties. This reduction of emission can be achieved by the firm installing chemical 'scrubbers' to clean the emission from the production of semiconductors. Hence, this can potentially reduce the MEC of production, leading to a more allocative efficient outcome as the reduction in MEC would lead to a reduced deadweight welfare loss to society. [Ev] The effectiveness of this measure is dependent on the degree of enforcement by the regulator/government. If enforcement is lax, firms will not have the incentive to comply with the regulations. In addition, regulations that are too strict might increase the cost of production for firms (Extract 4, para 1). There might be the unintended consequence where firms will pass these additional cost to the consumers, resulting in a rise in prices of the semiconductors and hence a rise in prices in other goods dependent on the component.	**[10]**

[P] The second policy that a government can use is a carbon tax also known as a pollution tax (Extract 4, para 2).

[E+E] A pollution tax is a compulsory levy imposed on producers, where firms have to pay the government a fixed fee per unit of pollution generated. The tax is aimed at encouraging firms to install equipment that reduces carbon emissions or to utilise cleaner production methods, so as to reduce the amount that the firm has to pay for the pollution tax. With this tax, rational firms will choose to lower pollution if the marginal benefit of lowering pollution (which is avoiding having to pay the pollution tax) outweighs the marginal cost of lowering pollution (e.g. installing equipment to reduce emissions). With the reduction of pollution emitted, the extent of the negative impact on third parties is reduced from MEC to MEC'. This would result in lesser welfare loss to society from area D and area C, resulting in an improvement in allocative efficiency. If the firms choose to pay the tax, their cost of production will rise and as profits decrease, they will also end up cutting back production.

[L]: This will also lower the levels of pollution in society and result in a more efficient allocation of resources.

Note: This diagram is not required for marking as part of the analysis. For learning purpose to show what might happen with a diagram.



[Ev] Governments might choose carbon taxes as a form of additional tax revenue (Ext 4, para 2) to fund projects that will reduce emissions for other industries as well. Furthermore, a fix price on carbon provides a greater sense of certainty for firms as their expected rate of returns can be estimated to a higher degree of confidence.

[P] The third policy a government can use is to implement an emission trading scheme (tradable permits) (Extract 4, para 3).

[E+E] The government first decides on the optimal level of pollution that is allowable. Once determined, the government can either auction the corresponding number of permits to pollute directly to firms or distribute the permits to firms.

After this initial allocation of permits, the firms are free to buy and sell the permits with each other, with the price of permits being determined in the market by demand and supply forces. Firms that acquire the permits acquire the right to

emit the given quantity of pollution. Firms do not all face the same costs of reducing pollution. Firms with high clean-up costs would wish to pollute above the quota of permits they were initially allocated. They may thus buy permits from other firms with low clean-up costs, who would rather pollute less than the quota assigned to them, so that they can sell their permit and earn revenue from it, adding to their profits. Thus, some firms are incentivised to find cleaner methods of production to reduce their pollution.

[L] The overall pollution level is reduced to the total allowable pollution that the government set, improving the allocative efficiency of the market as the reduction in MEC leads to a smaller deadweight welfare loss to society.

[Ev] However, the tradable permit scheme might cause uncertainty for firms.

From Extract 4, para 3, there is a significant rise in prices of permits over the life of the scheme which will inherently affect the firms' investment decision. In addition, the added cost of the permits might be significant to cause some firms to shut down.

Conclusion

[Stand] Each government will need to consider the needs of the market and the larger economy (especially when the industry contributes to a large portion of the country's GDP).

[Substantiation] For a smaller country such as Singapore, it will be easier to monitor the emissions of firms. Hence, it might use a combination of regulations and carbon tax, where enforcement of the regulations and tax collection is easier.

For larger countries such as South Korea, there will be a greater challenge to enforce tax collection and emission standards. Hence, the use of market forces to incentivise firms to reduce emissions would be more appropriate to reduce the regulatory oversight.

Furthermore, Singapore is relatively more reliant on Foreign Direct Investment and trade. Hence, Singapore requires a higher degree of business certainty/confidence than Taiwan and South Korea to maintain its price competitiveness; which pollution tax is more appropriate for.

Level	Descriptor	Marks
L2	Analytical and accurate explanation of the workings of at least 2 different measures in addressing the market failure problem. Answer is applied to the relevant context, with reference to case evidence.	4 – 7
L1	Some knowledge of how the measures work, or descriptive explanation of the workings of the measures.	1 – 3

E	In-body evaluation which recognises the contextual limitations and/or advantages of different measures. Evaluative conclusion on the appropriateness of the measures based on the context of the countries.	1 – 3

Markers' Comments

Content

- Most students were able to identify the correct cures from the extracts, but many were not able to draw the link to how the 3 policies work to reduce the MEC, which would reduce the extent of allocative inefficiency. Many students were able to explain how the policies worked but stumbled at making the final link to why allocative efficiency would improve.
- A small number of students wrote about government grants for R&D as a measure raised in Extract 4. Based on the extract, these government grants were funded by the tax revenue generated from pollution taxes. As such, in this context, it is more appropriate to mention this as a benefit of pollution taxes, rather than an independent policy altogether.
- **Tax on pollution vs tax on production**
    - Pollution tax was commonly explained exactly as an indirect tax on production along with the indirect tax diagram, which showed lack of understanding of the differences **between the intent** of both policies.
    - When students explained that a pollution tax will lead to producers comparing marginal benefit and marginal cost, it is not clear what was the exact decision producers were considering. It was often phrased as marginal benefit and marginal cost of production, which is wrong as the pollution tax will affect producers' decision on whether to reduce pollution, rather than whether to produce more or less semiconductors. Students need to articulate the decision/activity for which the producers are weighing the MB and MC of.
- Similarly, there was a misunderstanding about **regulation** in the case material. The regulation was on pollution level, rather than production level, that means **a total ban or a quota cannot be accepted**.There was often conflation of pollution and production (they are certainly related in the sense that a higher production level necessarily means higher pollution level, but they are not the same). While the regulations do increase marginal cost of production in that producers have to comply, this is an unintended consequence; the main intent is still to reduce the pollution and hence MEC, and improve the allocative efficiency.
- In the case of **tradable permits**, some students seemed confused as to how the policy addressed the market failure. The allocative inefficiency due to pollution is eliminated by the government setting the total permissible level of pollution - even if firms decide to buy permits from other firms and not switch to cleaner methods of production (which seems to be the case in South Korea, given the high permit prices), it does not mean that the policy is not effective, as pollution is still reduced to the permissible level determined by the government (assuming perfect information and effective enforcement).
- Also for the explanation on tradable permits, many students described how the firms decide whether to buy or sell the permits based on the size of the firms (small firms will buy less permits, vice versa). Small firms may

not necessarily be less pollutive compared to larger ones. Instead firms will decide based on the level of their clean-up costs and weigh it against the price of the permits.

- Limitations and/or strengths of the policies were often missing.
- In the overall conclusion, quite a number of students proposed that all 3 policies be used together to address the market failure generated from the production of semiconductors. While such a stand may be appropriate in many cases, thinking more deeply about this would help you to realise that this is unrealistic and infeasible - for instance, imposing regulations, pollution taxes AND a tradable permits system would mean triple penalising firms - no firm would want to operate in such a country.

Skills

- Case-based vs theoretical limitations
  - Rather than spamming one-liner limitations of policies, a good evaluative answer would elaborate on why this limitation is a concern and how significant the consideration is in the context of the country / situation.
  - For instance, one key limitation of tradable pollution permits given in the case material was the instability of prices that resulted from it and this uncertainty makes it difficult for firms to conduct investment decisions. In addition, it was also mentioned in the case that a carbon tax will hurt overall competitiveness by driving up costs of production. Very few scripts analysed or even mentioned these key limitations.
  - Most scripts fell back on theoretical limitations (if any) such as imperfect information of setting an ideal level of tax on pollution.
- For evaluation, students should learn to go beyond surface level examining of policies independently, and start to compare policies to come to reasoned judgements.
- When a question is posed as “Discuss the measures raised that… a government could adopt”, note that the question can be rephrased as “measures that a country could adopt”. Therefore, in the overall conclusion, students should consider that the nature of a country or the characteristics of the industry (e.g large manufacturing sector) in the country, may require different types of measures.
- Time management seems to be an issue as answers were often left incomplete with a missing overall synthesis evaluating whether certain policies may be more effective in certain contexts.

Essay Question 1

Increasing environmental consciousness has led to growing interest in electric vehicles. At the same time, technological advancement in battery production methods has contributed positively to the growth of the global electric vehicle market. The battery pack is the single most expensive part of an electric vehicle, accounting for about 30 per cent of the total cost.

(a) Using relevant examples, distinguish between the concepts of price elasticity of demand and cross-price elasticity of demand. [10]

(b) Discuss the likely impact of the above events on the total revenue earned by producers of electric vehicles and conventional fuel-powered vehicles. [15]

Part (a)

R1: Explain how PED and XED can be distinguished via their signs and magnitudes. **R2**: Explain how PED and XED can be distinguished via the factors that affect them.

Introduction

The price elasticity of demand (PED) measures the degree of responsiveness of quantity demanded of a good to a change in its price, *ceteris paribus*. PED is calculated based on the formula, $ED = \frac{percentage\ change\ in\ quantity\ demanded}{percentage\ change\ in\ price}$. Cross price elasticity of demand (XED) measures the degree of responsiveness of demand of a good to a change in the price of a related good, *ceteris paribus*. XED is calculated based on the formula, $XED = \frac{percentage\ change\ in\ demand\ for\ good\ A}{percetange\ change\ in\ price\ of\ good\ B}$.

The distinction between the two elasticity concepts can be explained by considering the **sign**, the **magnitude** and the **factors** affecting them.

Body

The **sign of PED** is **always negative** due to the inverse relationship between price and quantity demanded, in accordance with the law of demand. According to the law of diminishing marginal utility, the additional satisfaction that a consumer derives from successive units of output decreases and so the consumer will only be willing to pay lower prices for consuming more units of the good, ceteris paribus. For example, when the price of cars increases, quantity demanded of cars will fall.

On the other hand, **the sign for XED can either be positive or negative, depending on the type of relationship between the two goods in question.** The value of XED will be positive for substitute goods that satisfy the same needs. However, the XED value will be negative for complements that are consumed together to satisfy a specific need. For example, butter and margarine are substitutes that serve the same function as a spread. When the price of butter rises, the demand for margarine will increase as households will switch from buying the relatively more expensive butter to margarine since they are substitutes. The XED value of butter and margarine is therefore positive. Alternatively, cars and petrol are complements that drivers use together when they drive from place to place. Thus, when the price of cars increases, quantity demanded of cars will fall as it is more expensive to buy a car, and the demand for petrol will also decrease. The XED value of cars and petrol is therefore negative.
The magnitude of PED and XED are affected by different factors. **The magnitude of PED is affected by the number and closeness of available substitutes**. The more numerous and the closer the substitutes, the greater the PED value for the good. [E] For example, when the price of Meiji brand milk increases, there will be a more than proportionate fall in quantity demanded as consumers can

easily switch to the numerous other brands of milk like Daisy, Marigold or Farmhouse, which are relatively cheaper and are also close substitutes of Meiji brand milk since taste of milk is largely similar. Demand for the Magnolia brand milk is thus said to be price elastic and the absolute value of PED is more than 1. However, in cases where the good does not have many close substitutes, such as petrol, demand for the good will be price-inelastic and the absolute value of PED is between 0 and 1. When the price of petrol at the pump station increases, there will be a less than proportionate fall in quantity demanded as there are limited to no alternatives to petrol that consumers can switch to.

[A] On the other hand, the **magnitude of XED can vary depending on the closeness of the relationship between the two goods in question**. The stronger the relationship, the larger the XED value will be. For example, since butter and margarine are largely similar, and can be easily substituted for one another, they are considered close substitutes and XED value is likely to be positive and large. Thus, when the price of butter rises, households will switch to buying the relatively cheaper margarine and demand rises significantly. However, alternative energy sources like petrol and biofuels are weak substitutes, and the value of XED will be positive but small. The rise in price of petrol will result in a fall in quantity demanded for petrol, but the demand for biofuel increases less than proportionately since it may not be so easy to switch to the use of biofuels due to the lack of appropriate infrastructure like biofuel pump stations or electricity that runs on alternative energy.

Mark Scheme

Levels	Descriptors	Marks
L3	**Knowledge + Application + Analysis:** ● Thorough **distinction** of the two elasticity concepts ● **Clear** and **accurate** explanation of the two elasticity concepts, based on set of **criteria** including: (i) definition, (ii) interpretation of sign and magnitude, and (iii) determinants ● Good use of **examples** to illustrate the concepts *Note: recognition of formula for PED and XED required for L3-10m*	8 - 10
L2	**Knowledge + Application:** ● Undeveloped and/or descriptive explanation of the two demand elasticity concepts (XED and PED) ● Incomplete and/or inaccurate explanation of the two elasticity concepts, based on a set of criteria including: (i) definition, (ii) interpretation of sign and magnitude and (iii) determinants ● Mere explanation of the two concepts with little or no attempt at **distinguishing** between the two ● No examples given at all	5 - 7
L1	**Knowledge:** ● Contains theoretical errors ● Mere listing of points without much explanation	1 - 4

Markers' Comments

Content

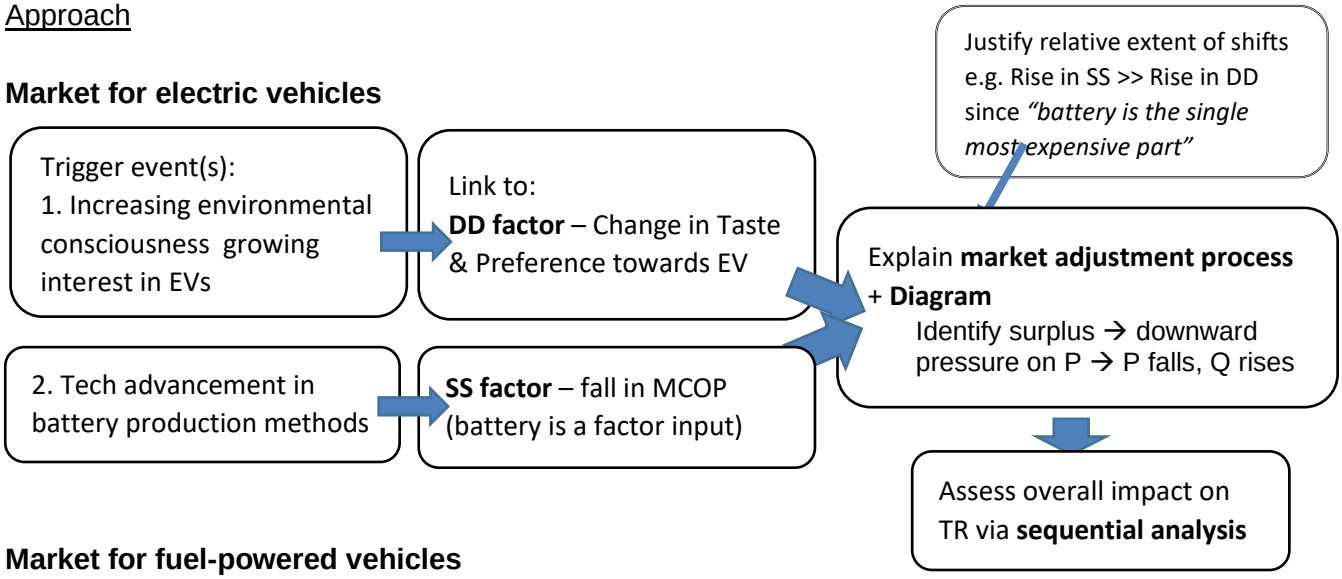
- PED and XED definition lacks the ceteris paribus assumption.
- Basic conceptual errors of PED and XED are still being made: PED is the responsiveness of **quantity demanded** (and NOT demand) to a change in price of the good, ceteris paribus whilst XED is the responsiveness of **demand** (and NOT quantity demanded) to a change in the price (and NOT demand) of a related good, ceteris paribus.
- Common errors/gaps in explanation for PED:
  - Many scripts argued that "PED is always negative due to the inverse relationship between price and quantity demanded" without any explanation of the economic theory underpinning this relationship.
  - Many scripts that presented 'proportion of income' as a factor for PED lack explanation in showing how a given % rise in price is going to be more significant (in absolute terms) for goods that take a high proportion of income, which is why more consumers would switch over to relatively cheaper alternatives, thus demand for said good is price elastic.
  - A handful of scripts used "number of substitutes" as a factor affecting the magnitude of PED. Note that it is **not** about the absolute number of substitutes available, but rather the availability of close substitutes that makes it easier/harder to switch when price changes.
  - Many students tended to stop at stating the factors affecting the sign/ magnitude (e.g demand for the good is price-elastic due to availability of close substitutes) without explaining why this is the case (i.e. ease of switching to alternatives)
- Common errors in explanation for XED:
  - Some scripts still mixed up the signs of XED for complements and substitutes.
  - Conflation between complements and factors of production. Some candidates used the preamble example and said that electric car batteries and electric cars are complements.
  - A handful of scripts wrote that "magnitude of XED determines the closeness of the related goods". This is incorrect. It is the closeness of the substitutes/ complements that determine the magnitude of the XED.
- Explanation of the PED, XED concepts was mainly theoretical without the appropriate use of examples. For scripts that did provide examples, they were often not well explained.
- Some scripts presented the signs and the values of PES and XED mechanically without explaining their significance.
- In general, most scripts neglected one or more of the required areas of discussion: sign, interpretation and factors.

Skills

- As the command word is "distinguish", there is a need to compare and contrast the PED and XED concepts rather than just explaining the two concepts separately.
- Many scripts simply listed examples without explaining. Infusing the examples to explain the elasticity concepts will demonstrate understanding.
- Many students do not know how to use examples - examples used should be very obvious ones and not subjective, particularly when it comes to close/weak substitutes; they should also be used as contrasting pairs to prove a point for e.g proportion of income spent on the good being a determinant of PED.

Part (b)

Approach



R1: Discuss the likely impact of the above events on the total revenue earned by producers of electric vehicles.
R2: Discuss the likely impact of the above events on the total revenue earned by producers of conventional fuel-powered vehicles.

Introduction

The impact of the above events on the revenue earned by producers of electric vehicles and conventional fuel-powered vehicles will be analysed using demand and supply analysis as well as relevant elasticity concepts such as price elasticity of demand and cross-price elasticity of demand. Demand refers to the willingness and ability of consumers to buy a good at various prices in a given time period while supply refers to the willingness and ability of a firm to offer a good for sale at various prices in a given time period.

Body

1. Explain the impact of the above events on the DD and SS of electric vehicles

[P] Increasing environmental consciousness leads to a rise in demand for electric vehicles
[E, E] Electric vehicle(EV)s are gaining popularity as people become more aware of the environmental benefits of switching to EVs, such as improvement in air quality. Governments around the world are also leading the switch to EVs, as part of efforts to promote sustainable development.

For example, the Singapore government has set a target to have all of Singapore's 5,800 public buses run on cleaner energy by 2040, and has since stopped all purchase of conventional diesel buses.

[L] This change in taste and preference towards EVs will result in a rise in demand for EV as consumers are more willing to consume EVs causing the demand curve to shift rightwards from D_1 to D_2.

[P] Advancement in battery production methods has significantly reduced the marginal cost of production for electric vehicles and thus, a <u>rise in supply</u> for electric vehicles.

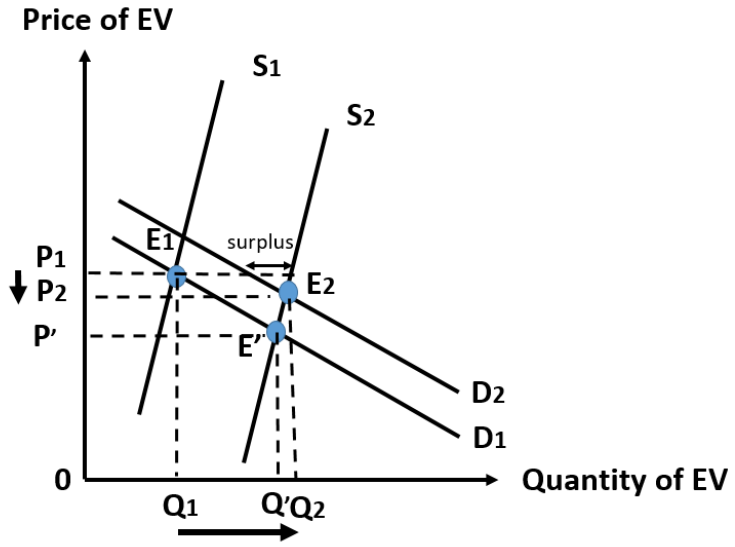
[E, E] Advancements in technology has made it cheaper to produce lithium-ion batteries. Since the lithium-ion battery is a key factor input in the production of electric vehicles, the fall in the price of lithium-ion batteries would lead to a fall in the marginal cost of production of electric vehicles, resulting in an increase in supply as production is now more profitable and hence firms are more willing to supply the good.

[L] Thus, supply increases, as represented by a rightward shift of the supply curve from S_1 to S_2.

2. Explain the market adjustment process and analyse the combined impact on equilibrium P and Q, taking into account the relative extent of shifts in DD and SS

[P] Extent of rise in supply is likely to be greater than the rise in demand of EVs

[Ev] The demand for EV increases but likely only to a smaller extent in the short term as time is needed to build the charging infrastructure. Currently, there is a lack of charging facilities, making it less convenient to own an EV and thus deterring consumers from switching. Additionally, some prospective car owners may also be concerned about the cost of having to replace the battery over time. On the other hand, with advancement in technology, there has been significant reduction in the cost of lithium-ion battery. Based on the preamble, the battery pack is the single most expensive part of an electric vehicle, accounting for about 30 percent of the total cost. The fall in the cost of the lithium-ion battery will significantly reduce marginal cost of production for electric vehicles, hence resulting in a significant increase in supply.



Since the rise in supply is likely to outweigh the rise in demand, at the original price P, there will be a surplus, leading to a downward pressure on prices. As price fall, quantity supplied will fall and quantity demanded will rise until a new equilibrium is achieved at the intersection of D_2 and S_2.

Hence, the new equilibrium would be at E' where the equilibrium price of EV will decrease from P_1 to P_2 while the equilibrium quantity will increase from Q_1 to Q_2.

3. Analyse the overall impact on total revenue by analysing the impact of the demand change and supply change on revenue sequentially

[P] The rise in demand, coupled with an even larger rise in supply, will lead to overall rise in total revenue

[E, E] Holding demand constant at D1, the rise in supply from S1 to S2 will result in a rise in TR from $0P_1E_1Q_1$ to 0P'E'Q'. Since EV is likely to take up a **high proportion of consumer's income, demand for EV is likely to be price elastic (|PED| >1).** Thus, a fall in price of EV will lead to a more than proportionate rise in quantity demanded for EV. The fall in TR due to the fall in price is less than the rise in TR due to the more than proportionate rise in quantity demanded for EVs. As such, there will be a rise in TR due to the rise in supply.

Holding supply constant at S2, a rise in demand from D1 to D2 will lead to an increase in TR from 0P'E'Q' to $0P_2E_2Q_2$. Since both price and quantity increases when demand increases, TR rises, reinforcing the increase in TR arising from the rise in supply.

[L] Overall, total revenue for producers of electric vehicles will rise.

<u>Market for Fuel powered vehicles</u>

1. Explain the impact of the above events on the DD and/or SS of fuel-powered vehicles

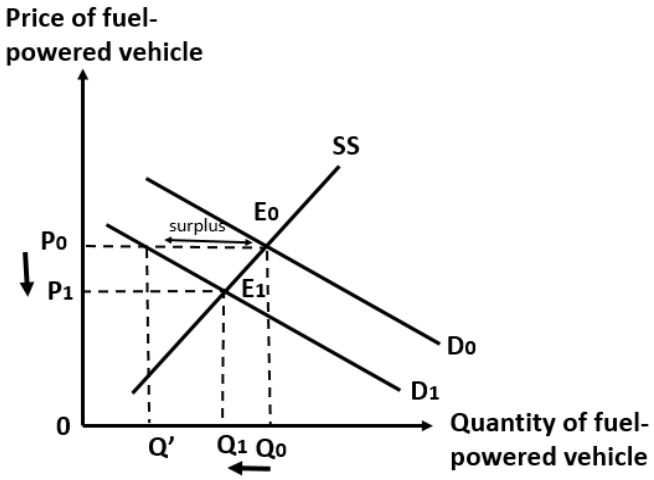
[P] Change in taste and preference due to increasing environmental consciousness, coupled with a fall in price of electric vehicles, will lead to a fall in demand for fuel powered vehicles, causing a fall in TR for fuel powered vehicle producers.

[E, E] Due to the change in taste and preference towards electric vehicles, this may result in an increase in demand for EV. Since **EVs and fuel powered vehicles are substitutes**, some people may be switching away from fuel powered vehicles.

At the same time, since electric vehicles and fuel-powered vehicles are substitutes (XED>0), when there is a fall in price of electric vehicles as analysed above, some consumers may also switch away from fuel-powered vehicles to the relatively cheaper electric vehicles instead. Thus, demand for fuel-powered vehicles will fall even further.

[L] Thus, demand for fuel powered vehicles falls from D_0 to D_1.

2. Explain the market adjustment process and analyse the impact of the DD shift on TR



At the initial equilibrium price of P_o, the quantity supplied would be Q_o but the new quantity demanded would be Q', leading to a surplus of Q_0Q'.This causes downward pressure on price as producers want to get rid of excess stock. As prices fall, quantity demanded rises and quantity supplied falls. This process continues until a new equilibrium is achieved at E_1 where equilibrium price and quantity falls to P_1 and Q_1 respectively.

Since both price and quantity falls, total revenue for fuel powered vehicle manufacturers will fall unambiguously from $0P_0\ E_0Q_0$ to $0P_1\ E_1Q_1$

Conclusion

For the Electric Vehicle market, the impact on total revenue will depend on the extent of shift of both demand and supply.

In the short term, it is more likely that the extent of shift in supply to be greater than the shift in demand for EVs. Most consumers still know relatively little about EVs and limited charging facilities also adds to the inconvenience. However, in the long run, with governments across the world creating more awareness and providing more incentives for people to adopt EVs, the shift to electric vehicles will come faster and in a more pronounced way. Moreover, continual investment in R&D to increase range (the maximum distance the EV can travel on a single charge) would also enhance the performance appeal of EVs. Additionally, the enhancement of charging infrastructure would also make it more convenient for drivers and encourage more car owners to switch to EVs. For example, in line with the Singapore Green plan 2030, the Singapore government has committed to plans to install 40,000 charging points in public carparks and 20,000 charging points in private premises by 2030. With these various plans in the pipeline, the demand for EVs is likely to increase more significantly in the future, and revenue for electric vehicle producers will increase even further.

As for the market for fuel powered cars, it is unlikely that there will be a significant fall in demand at least in the short run as at present, an EV still costs significantly more than a fuel-powered vehicle due to higher raw material costs. Therefore, for now, there should only be a slight fall in demand for fuel powered cars despite the fall in price of EV and hence only a slight drop in total revenue for fuel powered car manufacturers is expected. However, in the long run, as EV production technologies become more sophisticated and production costs are further reduced, and along with improvement in range, EV may be considered a stronger substitute and a fall in price of EV could lead to a significant fall in the demand and thus, revenue for producers of fuel-powered vehicles.

Mark scheme

Levels	Descriptor	Marks
L3	**Knowledge + Application + Analysis:** ● A clear and accurate analysis of how the events affect <u>both</u> supply and demand ● Clear and accurate **analytical** explanation of how the <u>combined</u> impact of the change in supply and demand affects **price, quantity** (through explanation of **market adjustment process**) and **total revenue** for both producers of electric vehicles and producers of fuel-powered vehicles. ● Includes **diagram(s)** that are accurately drawn and well-referenced Note: Requires application of at least either PED or XED to score L3	8 - 10
L2	**Knowledge + Application:** ● An underdeveloped answer that attempts to link the events to impact on price, quantity and TR for both markets. Answer is generally accurate but with some gaps in analysis. ● One-sided analysis that involves only either a shift in demand or shift in supply for the electric vehicle market OR ● A clear and accurate analysis of how the events affect for <u>one</u> market only Note: If no reference to TR at all, cap at L2-6m	5 - 7
L1	**Knowledge:** ● Mere listing of some demand and supply factors and assertions of how the events affects the price, quantity and total revenue ● Limited/ incorrect use of DD-SS tool of analysis ● Contains major conceptual errors	1 - 4
E3	**Well-reasoned judgment:** ● Makes a **well-reasoned** judgement on whether |PED|>1 or <1 ● Makes a **well-substantiated** judgement on the relative extent of shifts in DD and SS with reference to context ● Considers other possible outcome (e.g. impact in the short run v.s. long run) relating to impact on TR for both EV producers as well as producers of fuel-powered vehicles.	5
E2	**Largely unexplained judgement:** ● Makes some attempt to justify whether |PED|>1 or <1 ● Makes some attempt to justify the magnitude of the relative shifts but this is largely incomplete ● Attempts to consider at least 1 other possible outcome and/or perspective relating to impact on TR for either electric vehicles or producers of fuel-powered vehicles but this is not clearly explained or elaborated	3 - 4
E1	**Unsupported judgement:** ● Makes a stand with no further substantiation ● Makes a judgement stating that impact on TR depends on the relative extent of shifts but without substantiation	1 - 2

Markers' Comments

Content

- Gaps/ errors in explanation of DD/SS factor(s):
  - Many scripts were still missing the link to willingness/ ability to consume/ supply
  - For EV, the demand factor is taste and preference due to the environmental benefits which increases the willingness of the consumers to buy the cars. It has nothing to do with ability. Many students simply regurgitated the definition of effective demand in their explanation.
  - For the effect on conventional cars, XED was often used loosely - it should be the change in the price of EV cars which causes the demand for conventional cars to fall and not the rise in demand for EV cars. Also the closeness of the substitute which would have given rise to a more analytical response was missing from most scripts.
  - For the supply factor, there must be a link to the reduction of the marginal cost of production of EV due to the advancement in battery production as well as why the producers are more willing to supply the good, i.e because it is more profitable.
  - Mistakes such as a rise in demand leads to a rise in supply were still observed.
- Some scripts only shifted either demand or supply.
- Weak justification for the rise in supply being more than the rise in demand.
- Gaps/ errors in application of PED to analyse impact on TR:
  - Some scripts did not bring in PED, and even if some did, the PED value was sometimes not justified, rather just stated and applied. Whenever there is a change in SS, P and Q changes in opposite directions. Therefore, PED is required to assess the impact on TR due to the change in SS.
  - Many scripts incorrectly concluded that demand for EVs is price-inelastic due to the large proportion of income spent on the good. (Demand should be price-elastic)
  - PED was sometimes applied wrongly e.g. "rise in supply would lead to a fall in TR if demand for electric cars was price elastic" . This is incorrect. TR should rise since the fall in TR due to the fall in P is less than the rise in TR due to the more than proportionate rise in Q.

Skills

- Precise conceptual explanation of the demand and supply factor is required, with clear explanation of the price adjustment process. Also, price adjustment process should be explained before jumping into the sequential TR analysis.
- Some scripts made contradictions by saying demand for EV is price inelastic as there are no close substitutes in their TR analysis and then went on in the fuel vehicle analysis to say that EV and fuel vehicles are close substitutes. This suggests a need for planning out answers carefully before writing.
- Diagram drawing: some scripts drew the SS curve intersecting the DD on the wrong half of the DD curve, resulting in contradictory results.
- Weaker scripts were still comparing graphical areas to analyse impact on TR.
- It may be due to a lack of time but some scripts missed out the fuel vehicle market analysis altogether, and many scripts also missed out the evaluative conclusion.
- Most of the scripts provide evaluations that are general such as ceteris paribus assumption. Higher order evaluation will require a contextual and analytical evaluation based on conceptual justifications.

Essay Question 2

Singapore's healthcare system has evolved significantly in the last decade. There has been increasing focus on preventive healthcare to reduce the likelihood of future health complications, as well as to ensure our economic vibrancy. Amongst a slew of measures to encourage the consumption of healthcare, substantial subsidies are provided across a wide range of healthcare services.

Source: Adapted from *TODAYonline.com*, 2 January 2020

(a) Explain how market failure arises in the consumption of healthcare services. [10]

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

Suggested Answer and Mark Scheme

Part (a)

R1: Explain one source of market failure in the consumption of healthcare services (consumer ignorance). **R2**: Explain another source of market failure in the consumption of healthcare services (positive externalities).

Introduction

Market failure refers to the failure of the free market to allocate resources efficiently. Healthcare services are under-consumed when left to the price mechanism because of (i) consumers' failure to recognise the true benefits to themselves of consuming healthcare services, and (ii) the disregard of the external benefits generated from the consumption of healthcare services.

Body

(i) Consumer ignorance – under-estimation of the true benefits of consumption of healthcare services

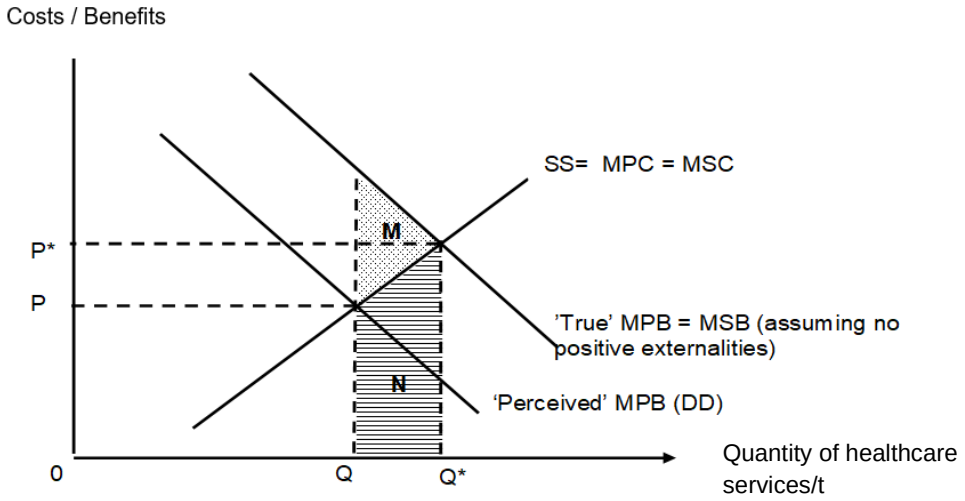
[P] One source of market failure in the consumption of healthcare services is that of consumer ignorance, due to imperfect information.

[E] The consumption of healthcare confers long-term benefits to one's own health and well-being. For example, preventive healthcare (e.g. regular health screenings) or early treatment of illnesses can help reduce the likelihood of health complications in the future. However, **due to imperfect information**, consumers may be ignorant about these long-term gains and **under-estimate the true benefits** that the consumption of healthcare services provides.

[E] With reference to Figure 1, **the under-estimation of benefits by consumers causes the perceived marginal private benefit (MPB) to be lower than the true MPB** of consuming healthcare. Due to imperfect information on their end, consumers would base their consumption

decision on their perceived MPB and hence the **perceived MPB** curve is also the **market demand curve**. Assuming no externalities, the marginal social benefit (MSB) curve will be the same as the true MPB, while the marginal social cost (MSC) curve is the same as the marginal private cost (MPC) curve, which is also the supply curve.

Figure 1: Consumer ignorance in the healthcare services market



Left to market forces, the **market equilibrium quantity of healthcare services produced and consumed will be at Q**, where demand equals supply. The **socially optimal quantity, however, is higher at Q*, where MSC = MSB,** where society's welfare is maximised. Since the market equilibrium is at Q, there is an **under-consumption of healthcare of (Q* - Q)** units in the free market. For Q to Q* units, the MSB is greater than the MSC, which means that there is additional gain to society's welfare that could have been reaped if more healthcare services were consumed. At the output level Q, a **deadweight loss of area M** is incurred by society, as from Q to Q* the total social benefit (areas M+N) is greater than the total social cost (area N).

[L] Since society's welfare is not maximised due to consumer ignorance, the free market has failed to achieve allocative efficiency, resulting in market failure in the consumption of healthcare services.

(ii) Positive externalities from consumption of healthcare services

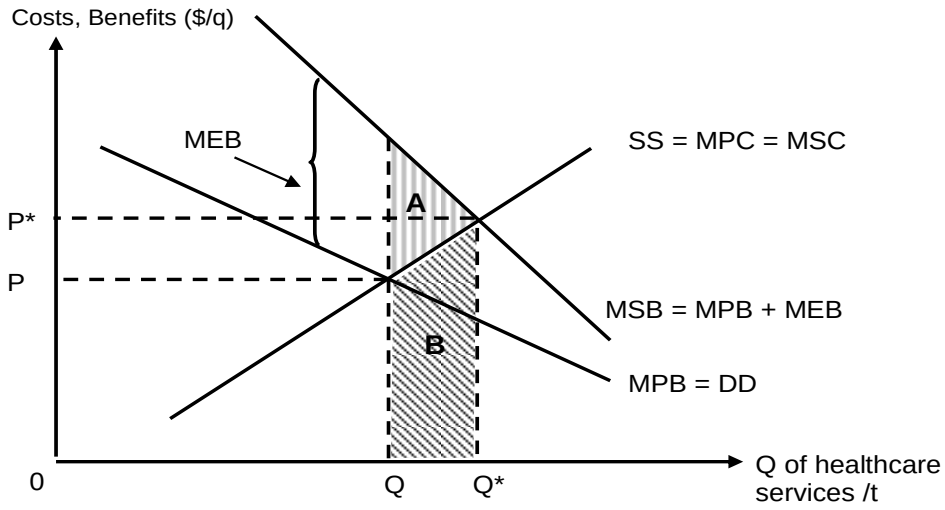
[P] Another source of market failure in the consumption of healthcare services is that of positive externalities.

[E] The consumption of healthcare services also benefits third parties, such as employers or even the wider economy, who enjoy external benefits although they are **not involved in the consumption (or production) of the good**. The consumption of healthcare services (e.g. preventive healthcare) could lead to better treatment outcomes for employees. Their employers stand to benefit from lower absenteeism and greater cost savings from healthcare benefits. Furthermore, employees may be more productive which not only lowers the cost of production for firms, but also increases the productive capacity of the economy, contributing to sustained economic growth and ensuring Singapore's economic vibrancy.

[E] The **positive externality causes the MSB of consuming healthcare services to be greater than the MPB**, since the additional benefits to society (MSB) includes both the additional

private benefits to individuals consuming the healthcare services (MPB) as well as the additional benefits to third parties not involved in its consumption (MEB). With reference to Figure 2, the existence of the MEB causes the **MSB curve to be higher than the MPB curve**, where MEB is the vertical distance between the MSB and MPB curves.

Figure 2: Positive externalities in the healthcare services market



Under the free market, rational consumers will base their decisions on their MPB, and disregard the external benefits. Assuming there are no negative externalities, MPC = MSC. Left to market forces, the **market equilibrium quantity of healthcare services produced and consumed** will be at Q where demand equals supply (which is also where MPB = MPC).

However, the **socially optimal quantity is higher at Q*, where MSB = MSC** and society's welfare is maximised. Hence, under the free market, there is an **under-consumption of healthcare services by (Q* - Q) units, resulting in welfare loss to society (also known as the deadweight loss).** This is because for Q to Q* units of healthcare services, the MSB is greater than the MSC, i.e. there would have been a gain to society's welfare had Q* - Q more units of healthcare services been consumed. The deadweight loss of consuming at the market equilibrium output Q is represented by area A given that the total social benefit of consuming Q to Q* units (areas A+B) is greater than the total social cost (area B).

[L] Since society's welfare is not maximised due to the generation of positive externalities, the free market has failed to achieve allocative efficiency, resulting in market failure in the consumption of healthcare services.

Conclusion

In conclusion, the free market fails to achieve allocative efficiency due to consumer ignorance causing an under-estimation of the true private benefits as well as the presence of positive externalities arising from the consumption of healthcare services. There is thus a case for government intervention in the market for healthcare services.

Mark Scheme

Level	Descriptor	Marks
L3	• Well-explained answer that demonstrates understanding of how consumer ignorance and positive externality lead to market failure in the case of healthcare services • Diagrams are used appropriately and accurately • Includes contextualised examples in the explanation	8-10
L2	• A good and thorough explanation of **either** positive externalities or consumer ignorance OR • Under-developed answer with gaps in the explanation of how consumer ignorance and positive externality lead to market failure	5-7
L1	• Demonstration of understanding of what market failure / positive externalities / information failure / merit good is • Knowledge of concepts with little or no explanation • Conceptual errors and inaccuracies in explanation	1-4

Note:
If candidate explains **supplier-induced demand** in part (a), explanation can be accepted, although this is not referred to in the preamble. However, the candidate will need to be able to point out clearly that this results in ***over-consumption*** of certain healthcare services (instead of the under-consumption explanation for both consumer ignorance and positive externalities), and in part (b) explain at least one policy to deal with the market failure arising from supplier-induced demand (e.g. regulating of physician charges such as by requiring them to publish their charges, provision of information to consumers to reduce extent of asymmetric information, change in fee remuneration structure among doctor and insurer).

Markers' Comments

Content

- While most students made the effort to provide contextualised examples when explaining both the positive externalities and consumer ignorance problems, some scripts either did not explain the sources of market failure **in context**, or merely lifted from the preamble without elaborating, at least briefly. Without providing contextualised examples, the script will be capped at L2 no matter how well you can theoretically explain how both sources of market failure arise.
    - For instance, in the case of positive externalities, students can try to make the connection to the **economic benefits** that result from the consumption of healthcare services.
- Students need to be specific when explaining the positive externality in terms of the effect on a 3rd party. For example, merely stating that healthy workers will benefit their employers is not sufficient and they should link it to a specific benefit such as increased profits. Similarly, when explaining consumer ignorance, students should also be more precise when explaining the long term benefits that consumers are unaware of. E.g cost savings from having to spend less to cure an illness if detected early.
- Explanations of the impacts on 3rd parties are very vague - consuming healthcare services may not prevent others from being sick as not all illnesses are contagious.
- When explaining the deadweight loss, students seem to blindly state that there is underconsumption of (Q* - Q) units since MSB > MSC and TSB > TSC. It is important to know what these mean -- for **every** unit of healthcare services consumed from Q to Q*, the MSB would be greater than MSC. This means that for (Q* - Q) units not consumed, TSB > TSC, meaning that there is **net benefit to society that could have been reaped** had these (Q* - Q) units been consumed.
- Other common gaps/errors in explanation:

- A handful of students did not explain how Q and Q* were derived, and just stated that there was underconsumption of (Q* - Q) units.
- Even when the above was explained, some students did not use the correct curves in deriving Q and Q*. For instance, since Q* is the **socially** optimal quantity, it is most accurate to say that Q* occurs at the intersection of the M**S**B and M**S**C, not MPC or SS, even though we may have assumed no negative externalities such that SS = MPC = MSC). Likewise, in the case of consumer ignorance, it is most accurate to say that the private optimal quantity is at Q where perceived MPB = MPC and DD = SS, and not e.g. perceived MPB = SS (DD/SS are market concepts involving consumers' and firms' willingness and ability to (...), while MPB/MPC in this case are based on individuals' cost and benefits).
- A few students did not explain that there was **underconsumption** of healthcare services, based on the difference between the private and socially optimal quantities.
- Derivation of deadweight loss not explained.
- Diagrams wrongly labelled e.g. the vertical axis should read "Costs/Benefits" or "Price/Costs/Benefits", not just "Price", since we are comparing the benefits and costs when analysing how the market failure arises.
- Very rarely but it happens, the deadweight loss area is identified wrongly.

- The "ordering" of the steps to explain the market failure did not make sense in some scripts, which may be a sign of either confusion of how the market failure arises or that students merely memorised the steps without understanding the concepts fully.
- Assumptions are sometimes written wrongly. When explaining positive externalities, it does not make sense to state "assuming no externalities" since students have already identified that there are positive externalities. When explaining consumer ignorance, it is not complete to only state "assuming no negative externalities" as we are also assuming no positive externalities.

Skills

- Students should make use of the preamble to explain, in this case, the sources of market failure.
- While a handful of students attempted to combine both sources of market failure into one diagram before explaining, this tended to result in descriptive analyses of how market failure arises in each case.

Part (b)

R1: Explain one policy adopted by the SG government to correct consumer ignorance in the consumption of healthcare services.
R2: Explain one policy adopted by the SG government to correct positive externalities generated in the consumption of healthcare services.

Ev: Weigh and evaluate policies based on effectiveness and appropriateness in the SG context.

Introduction

In both cases explained in (a), market failure arises from an under-consumption of healthcare services. The Singapore government intervenes significantly in the market for healthcare services in a bid to encourage consumption to the socially optimal level Q*. We now evaluate some of the policies adopted by the Singapore government to correct the two sources of market failure explained in (a), in terms of their effectiveness and appropriateness.

Body

[P] One policy that the Singapore government utilises is that of public education on the benefits of consuming healthcare services, to correct its under-consumption due to consumer ignorance.

[E] Public education addresses the problem of consumer ignorance, by educating consumers on the true marginal private benefits of consuming healthcare services. Through the Health Promotion Board, the government has been carrying out public health campaigns such as road shows to educate the public, and programmes such as the Screen for Life programme and the Let's BEAT Diabetes programme. These efforts provide information about the importance of healthcare and the potential health risks of certain diseases, and encourages individuals to adopt a preventive approach to healthcare by keeping healthy and avoiding activities that pose health risks. This reduces the extent of information failure in the market and encourages consumers to increase their consumption of healthcare services as they improve their individual decision making.

[E] With public education, consumers are made aware of the true MPB of consuming healthcare services. Hence, the perceived MPB will increase closer to the true MPB. This increases consumers' willingness to consume healthcare services and demand increases (based on the higher MPB). In the event that such public campaigns are perfectly successful in closing the information gap such that the perceived MPB aligns with the true MPB = MSB, the new private equilibrium output, will coincide with the socially optimal output Q*, and the initial welfare loss of area M in Figure 1 will be eliminated.

[L] This eliminates the allocative efficiency in the market for healthcare services and corrects the market failure.

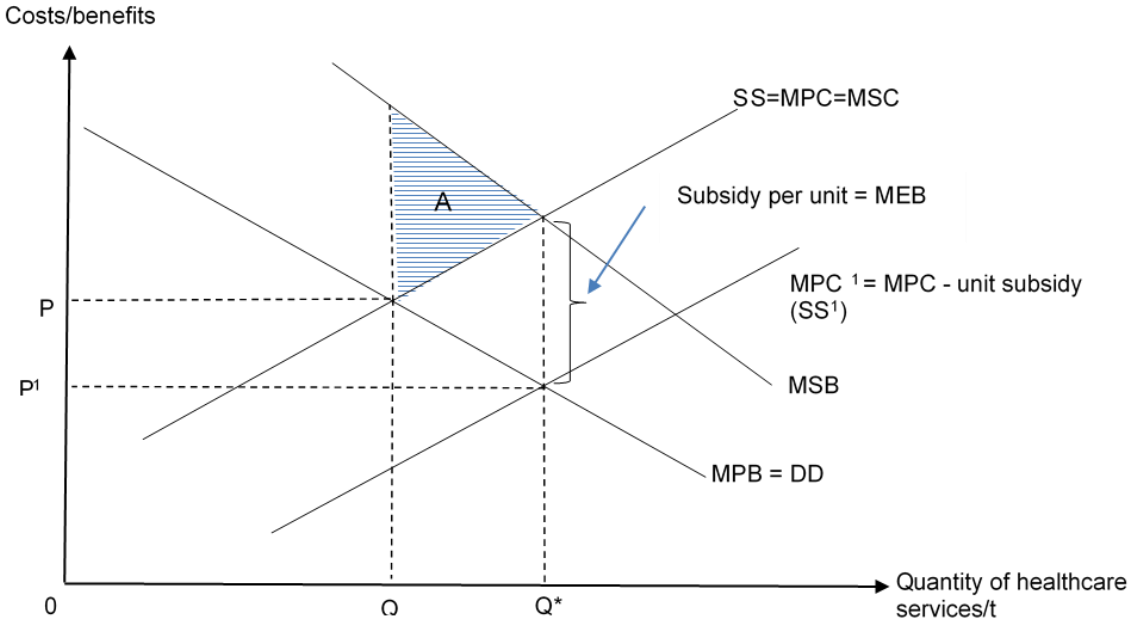
[Ev] However, public education usually requires a longer time to achieve their desired effects, as it takes time for consumers to adjust their mindsets and perspectives. The effectiveness of this policy is also uncertain, as it is highly dependent on consumers' receptiveness to the information provided. The success of the campaign also depends on how wide the outreach is. Hence, in the short run,

public education efforts by the Singapore government to increase the consumption of healthcare services might not be very effective.

[P] Another policy that the Singapore government adopts is that of production subsidies, to address the market failure arising due to positive externalities from consumption of healthcare services.

[E] Subsidies are provided to producers to encourage the production of good and services. To correct the market failure due to positive externalities, the Singapore government provides substantial subsidies across a wide range of healthcare services, including for hospitalisation, outpatient care and long-term care. Under the Community Health Assistance Scheme (CHAS)[1], for instance, extensive subsidies are provided for a range of healthcare services such as common illnesses, selected chronic conditions, dental services and selected health screening services. In Figure 3, such subsidies can be depicted by a per unit subsidy on healthcare services equal to the MEB at the socially optimally output, Q*.

Figure 3: Subsidies to increase consumption of healthcare services



[E] A subsidy will decrease the price of consuming healthcare services and incentivises consumers to internalise the external benefits of consuming these services. The subsidy reduces producers' marginal cost of production, causing supply to rise. The SS curve (MPC) will shift vertically downwards to SS' (MPC') by the amount of MEB at Q* as shown in Figure 3. With the increase in supply, a surplus is created at the original equilibrium price, thus driving down prices. With a lower price, consumers will be encouraged to consume the services, via a rise in quantity demanded for healthcare services.

Assuming the government has perfect information on the amount of the per unit subsidy, there will be a rise in market equilibrium quantity of healthcare services from Q to Q*. The new market equilibrium output (where SS' = DD) coincides with the socially optimal output Q* (where MSB =

[1] Note that most subsidies in CHAS subsidies are means-tested (criteria set based on household monthly income per person or annual value of one's home). Essays on the context of healthcare can also be framed more broadly, to ask about both market failure (merit good) and inequity – e.g. "Explain why governments intervene in the market for healthcare services".

MSC), causing the original welfare loss of area A to be eliminated and allocative efficiency to be restored.

[L] As a result, healthcare subsidies correct the market failure in the market for healthcare services by increasing its consumption.

[Ev] However, due to imperfect information on consumer demand, the Singapore government may not be able to accurately estimate the level of MEB at the socially optimal output Q*. As a result, they may set a per unit subsidy that is too high or too low, which would then result in under- or over-consumption, in which case allocative inefficiency persists and the market failure is not corrected. In particular, providing a subsidy that is too high may result in excessive overconsumption of healthcare, such that the welfare loss to society from overconsumption results in a worse outcome than under the free market.

[Ev] The demand for healthcare services may be price elastic or price inelastic, depending on the nature of the service and its necessity to the consumer. For instance, the demand for health screening services (part of preventive healthcare) may be price elastic since it can take up a high percentage of one's income. Therefore even a small subsidy can be effective in increasing the consumption of these health screening services, as there will be a more than proportionate rise in quantity demanded for the services. Subsidies will thus effectively address the under-consumption problem and be effective in correcting the market failure. On the other hand, the demand for long-term care services may be more price inelastic, as there is a high degree of necessity for those who use these services and very few close substitutes available. In this case, a large subsidy is required to increase consumption of health screening services to the socially optimal output, as the fall in price from the subsidy is likely to result in a less than proportionate rise in quantity demanded.

[P] The Singapore government also implements regulations such as compulsory vaccinations to increase consumption of certain healthcare services.

[E] For instance, the Singapore government makes certain vaccinations compulsory by law to ensure the positive externalities generated from the consumption of vaccines are internalised. Under the Infectious Diseases Act, vaccinations against diphtheria as well as measles, mumps and rubella (MMR) are compulsory for children in Singapore as part of the National Childhood Immunisation Programme.

[E] The compulsory vaccination may be effective in addressing market failure in the market for vaccines as it *compels* consumers, by law, to internalise the positive externalities generated and increase their demand for vaccines. Their consumption of vaccines will then increase from the current private optimal level Q to the socially optimal level Q*.

[L] As a result, allocative efficiency is achieved and the market failure due to positive externalities generated in the consumption of healthcare services – in this case, vaccinations – is corrected.

[Ev] As long as the regulations are clear and properly enforced, the outcomes are more certain and can be achieved faster than the use of subsidies. This means that there is a need for strict monitoring to ensure compliance to the rules, which could be administratively costly. However, due to Singapore's relatively small population size, there should be greater ease in ensuring compliance with rules and the monitoring and enforcement costs would likely not be too high. In Singapore, the implementation of compulsory vaccinations has been largely effective in ensuring that majority of children receive their vaccinations by two years old.

Alternative answer – Candidates may write about free provision as a policy option, but it has to be contextualised in the Singapore context to be accepted.

Conclusion

[Stand] The range of policies adopted by the Singapore government to correct the sources of market failure in the market for healthcare services have largely been effective in increasing its consumption.

[Substantiation] In terms of effectiveness, as explained above, the Singapore government implements a range of policies to address the **root cause** of the two sources of market failure – in the case of consumer ignorance, public education is used to address or at least reduce the information failure, while for positive externalities, a mix of market-oriented and command policies (subsidies and regulation respectively) are used to encourage and/or ensure consumers internalise the positive externalities from the consumption of certain healthcare services. The **differentiated policy treatment for different healthcare services** also ensure that the under-consumption of services such as vaccinations that generate higher positive consumption externalities (and hence greater allocative inefficiency in the absence of government intervention) is more immediately and effectively corrected, as compared to other services such as general health screenings.

Further, the **mix of policies used to encourage the consumption of healthcare services work together in both the short run and the long run**. For instance, while public education ultimately solves the root cause of the information failure problem, regulations can also be used in the interim to ensure the socially optimal level (Q*) of certain healthcare services is consumed, while at the same time working to educate consumers and change their mindsets.

Nonetheless, there is a **need to periodically review the policy mix adopted by the Singapore government in the market for healthcare services to ensure that they continue to remain effective and appropriate to the context**. For instance, **in the longer run, given Singapore's ageing population**, there may be a need for the Singapore government to increase its healthcare policy focus on elderly care. General lifestyle changes and technological advancements may also require changes in the government's approach to or spending on healthcare services. Lastly, there may also be a need to review the **long-term sustainability** of Singapore's existing mix of healthcare policies, in the event that rising healthcare costs and expenditure render our current approach fiscally unsustainable.

Mark Scheme

Level	Descriptor	Marks
L3	For an answer that provides an analytical and rigorous explanation of at least two policies that the Singapore government **has adopted** to tackle **both** sources of market failure explained in part (a), as well as their limitations, with strong application to context. Diagrams are used appropriately and accurately. *If no application to Singapore healthcare system context at all, cap at L3 – 8.*	8-10
L2	For an answer that provides theoretical / descriptive explanations of at least two policies that address the sources of market failure explained in (a), with weak application to context. OR For an answer that contains only one well-explained policy with strong application to context. *Note: If policies only solve one source of market failure explained in part (a), cap at L2 – 6.*	5-7
L1	For an answer that demonstrates some knowledge of policies used to tackle allocative inefficiency resulting from positive externalities and/or consumer ignorance, with little or no explanation. Conceptual errors and inaccuracies in explanation.	1-4

Level	Descriptor	Marks
E3	For an answer provides **supported evaluative statements** and arrives at an **analytically well-reasoned and synthesised judgement** about the policies the Singapore government has adopted in the market for healthcare services.	5
E2	For an answer that makes **some attempt at supported** evaluative statements about the policies the Singapore government has adopted in the market for healthcare services.	3-4
E1	For an answer that gives an **unsupported** evaluative statement about the policies the Singapore government has adopted in the market for healthcare services.	1-2

Markers' Comments

Content

- This question requires students to be aware of the policies **being adopted by the Singapore government** in the context of healthcare services. Many scripts did not even attempt to bring in contextualised examples of the policies, and merely relied on theoretical explanations and limitations. For a question on Singapore, there is some expectation that students would at least know some actual policies implemented given that it is a lived experience.
    - Many scripts started their paragraphs with "The Singapore government can adopt…", which is not what the question is asking.
- In general, just like for the CSQ d(ii), policy explanations lack the final link to **how the market failure is corrected** (or at least reduced).

- Similarly, explanations of policy limitations tend to be descriptive and lack the final link to how this limitation means that the policy may not be as effective or appropriate, in the SG context. In general, examples were lacking resulting in highly theoretical essays.
- Common issues with explanation of **production subsidies**:
  - For **consumption** externalities, it is **not** the firm that internalises the externalities, but **consumers** that do so. In this case, when the production subsidy lowers the mCOP for firms, the rise in supply and fall in price will lead to a rise in Qd by consumers -- this is where **consumers** internalise the external benefits from consumption of healthcare services.
  - A handful of students wrongly explained that the subsidies serve to reduce the positive externalities -- this is not correct and does not make any sense; the policy intent is to **get consumers to internalise the MEB** (not to reduce it) by increasing their consumption of healthcare services.
  - Quite a number of students explained that subsidies would increase consumers' demand for healthcare services. This is not true -- since subsidies allow consumers to enjoy lower prices for healthcare services, it is the **quantity demanded** that increases (price factor), not the demand. Or students should at least just state that consumption will increase given the lower prices.
  - Diagrams used to accompany the explanation for production subsidies should be in the context of Market Failure, not DD-SS, as the idea is to show how the underconsumption and welfare loss are both reduced/eliminated. This is not possible with a DD-SS diagram.
  - While the attempt to bring in Singapore based examples was appreciated, Medisave and MediShield Life are not production subsidies. Medisave and Medishield should come under government regulation.
    - Medisave is a mandatory personal savings account for healthcare expenses. The Singapore government does give top ups to this account on some occasions but that would function more like a grant for consumers rather than production subsidies for producers.
    - MediShield Life is a national basic health insurance plan which can pay for costly treatments. Again, this is a personal insurance plan which is unrelated to subsidising producers.
    - It is more correct to refer to the subsidies the government gives to hospitals and polyclinics as production subsidies.
- Common issues with explanation of **regulation**:
  - Because regulations compel individuals to abide by the law set, students should explain that consumers therefore are compelled by law to **increase their demand** for the specific healthcare service e.g. childhood vaccinations. And they will do so due to the higher MPB that comes with not being punished.
- Common issues with explanation of **public education**:
  - Many scripts explained how public education causes perceived MPB to move towards true MPB, without making the final link back to how this impacts the new equilibrium quantity, which coincides with socially optimal output Q*.
  - Public education should not reduce the MEB of consuming healthcare services -- firstly, it does not make sense to implement a policy to try and reduce positive effects on others; secondly, public education serves to solve the consumer ignorance issue, not positive externalities, so there is no place for the mention of MEB.
- Quite a number of scripts explained free direct provision -- the SG government does not do free direct provision for healthcare services in general. However, if explanation is done with specific reference to certain healthcare services (e.g. COVID-19 vaccinations), they would be relevant to the question.
- Given the nature of this question, the **evaluative conclusion** requires substantiated assessment of the effectiveness and/or appropriateness of the policies **based on the SG context**. Evaluative comments were usually theoretical. Again, knowledge of the context of Singapore is expected.
- Given that there are both positive externalities and consumer ignorance problems, some students did not realise that a mix of policies tackling both sources is necessary. Many scripts

keep claiming that public education is best as it tackles the root cause without realising that it does not solve the problem of positive externalities.

Skills

- While the question was about “healthcare services” many students did not recognise that different policies are used for diff types of healthcare services, depending on the nature of benefits conferred as well as root cause of market failure. This could have been used as part of a good synthesis, esp if the example used clearly pointed in that direction.
- Some students did not explain any limitations of the policies, only making brief mentions of them in the synthesis/conclusion. This resulted in the essay being one-sided. “Discuss”/”Evaluate”-type questions require you to bring in >1 perspective -- in this case, to recognise the limitations (or bring in the merits) of policies after explaining them.
- Owing to time management issues, some students did not manage to round up their essays with a conclusion. If there was no synthesis/conclusion at all and no in-body evaluation done **based on the SG context**, this usually led to students losing all 5 evaluation marks.
- Some students went too far to explain how the policies can improve equity, which was not the aim of the question to improve the allocative inefficiency.
- The link to the context of Singapore was poorly attempted, and as a result, students could not evaluate the essay with a reasoned judgement.

Essay Question 3

In 2020, investment in fixed capital formation in Singapore totalled S$100.9 billion, making up 21.5% of GDP.

Source: SingStat

(a) Using AD-AS analysis, explain how a rise in investment expenditure can bring about economic growth in an economy. [10]

(b) Discuss whether economic growth will always lead to a higher standard of living for residents of a country. [15]

Suggested Answers

Part (a)

R1: Explain how a rise in I brings about actual growth in an economy. **R2**: Explain how a rise in I brings about potential growth in an economy.

Introduction

There are two types of growth - actual and potential growth. Actual growth occurs when the equilibrium real national output (Y_e) rises while potential growth occurs when there is an increase in the full-employment national output (Y_f). We can use the AD-AS model to illustrate how a rise in investment expenditure affects the actual and potential growth.

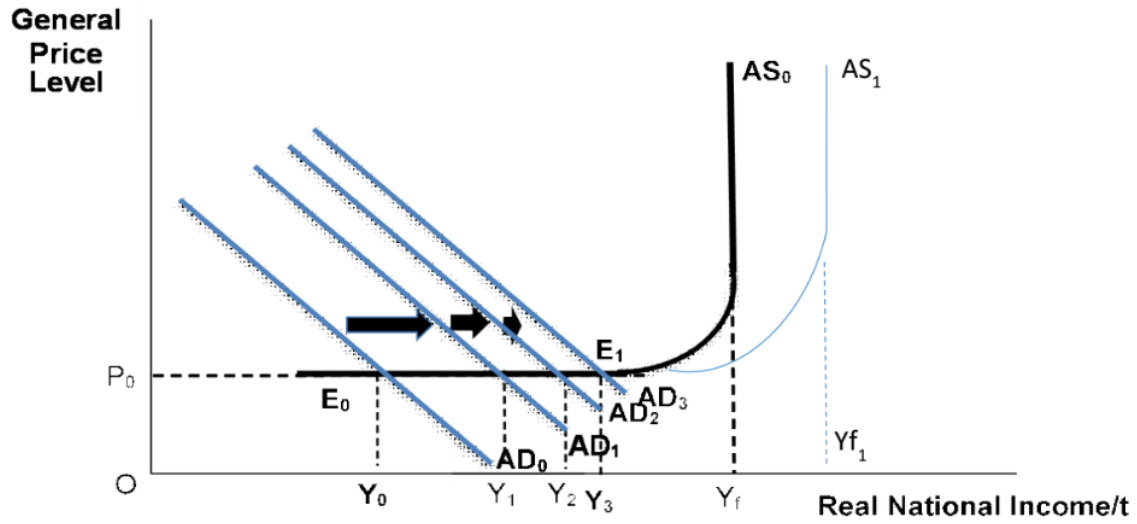
A country's national output level changes when components in the Aggregate Demand (AD) changes. A change in the Aggregate Supply (AS), which is affected by factors such as the quantity and quality of a country's resources can also result in a change in national output.

Body

Explain how a rise in investment expenditure leads to a rise in AD and actual growth

[P] The rise in investment expenditure will lead to a rise in the AD
[EE] The AD comprises expenditure from household's consumption (C), firms' investment (I), government spending (G) and trade sector (X – M). X refers to export revenue while M refers to import expenditure. At the initial equilibrium, where AD intersects the AS, the total injection is equal to the total withdrawals in the economy. At this point, planned expenditure is equal to the planned output. When there is a rise in investment expenditure, expenditure reflected by the AD will rise as a result of the higher level of injection.
[L] Ceteris paribus, the rise in I will lead to an increase in the AD.

[P] The rise in injection as a result of the increase in AD will lead to a multiple increase in national income.
[EE] Assuming that the economy is initially operating at spare capacity, an increase in AD (from AD_0 to AD_1) due to the increase in investment expenditure would lead to an unplanned fall in inventories for firms. Thus, firms will increase their production to meet planned levels of inventories. Firms will hire more factors of production such as labour to increase production, and national output / income increases.



As households receive more factor income for their services, they spend a portion of this additional income on domestic goods and services, causing a rise in induced consumption and thus AD. In this second round of planned expenditures, AD shifts from AD_1 to AD_2. With the increase in spending, this creates another round of unplanned fall in inventories in other industries, and the process repeats itself where the households will spend part of the income on consumption of domestic goods and services, and the remaining will go to savings, taxes and imports. This process of increase in induced consumption of domestic goods/services and increase in output and income will continue until total withdrawals equal total injections again and a new equilibrium national income is achieved.
[L] The initial increase in AD would thus have led to a **multiplied** increase in national income (from Y_0 to Y_3) due to the multiplier effect, assuming spare capacity in the economy. Hence, actual growth occurs.

Explain how a rise in investment expenditure leads to potential growth (rise in AS)

[P] The rise in investment expenditure can also lead potential growth
[EE] The rise in investment expenditure can lead to increased capital stock in the economy. Investment spending refers to spending by firms on new capital goods such as fixed capital and inventories. As long as the additional spending on fixed capital exceeds depreciation, there will be an increase in capital stock. As the capital stock increases, the capacity of an economy to produce rises. This rise in capacity can be illustrated by a rightward shift in the vertical portion of the AS curve from AS_0 to AS_1.
[L] Hence, investment spending can bring about potential growth in an economy as seen in the diagram the full employment level of output rising from Yf to Yf_1.

Conclusion
Hence, we can see that the rise in investment expenditure that caused the AD to shift rightwards under the condition of spare capacity leads to actual growth. At the same time, it can also bring about potential growth. If the economy is operating close to the full employment level of output, the rise in AD and AS can bring about sustained economic growth.

Mark Scheme

Level	Descriptor	Marks
L3	● Well-explained answer that demonstrates understanding of the AD-AS model and how a rise in investment expenditure can lead to a multiple rise in national income (k process for actual growth and rise in capacity).	8 - 10
L2	● A good and thorough explanation of **either** AD-AS model or how national income rises via the multiplier process (explanation as per notes on P. 54) **Note:** Max 7m: if answers contain only AD and k process explanation Max 6m: if answers contains only AS explanation (ie. fall in UCOP AND rise in capacity due to investment in technology) Max 5m: if answers contain only AD explanation without k process	5 - 7
L1	● Demonstrates some understanding of the AD-AS model ● Shows knowledge of concepts with little or no explanation	1 - 4

Markers' Comments

Content

- For actual growth
  - Many scripts did not state that households withdraw their savings, taxes and import expenditure when national income increases after the first round. Instead,most merely state that a portion would be spent on domestic goods and services. This shows the gap and thoroughness in explanation.
  - Some students did not link the rise in output back to the question, which is actual growth.
  - A couple of students wrote that the first shift in AD is due to autonomous consumption or induced consumption, both of which are wrong. The first shift is due to the rise in investment expenditure.
- For potential growth
  - Many scripts stopped at explaining increasing AS leading to an increase in productive capacity without making reference to the full employment level of output (Y_f). Expression is wrong because the rightward shift in the AS curve shows that capacity has increased. The cause of it was due to the rise in net investment (ie. capital accumulation > depreciation of capital).
  - Many scripts had gone straight to state that the capital stock increased without explaining how the impact of investment vs capital depreciation rate increases the net capital stock. The assumption that the level of gross investment is higher than capital depreciation is also often missing.
  - Some scripts explained very loosely that investment expenditure increases quality and quantity of factors of production. This is vague without specifying the factor of production. Some of these responses wrongly explained that the quality of capital improved with investment expenditure. This is inaccurate because firms buying more machinery does not necessarily lead to innovation to improve these machines or make them of higher quality.
  - A handful of scripts wrongly linked investment expenditure to improving human capital. This is not correct as investment expenditure (fixed capital formation) is solely on capital goods (e.g. machines), and does not improve human capital (e.g. skills).
- For the explanation on multiplier process
  - Students who used numerical examples to explain the process need to link their explanation to the question, which is about economic growth. Hence, the presence of

spare capacity and withdrawals should also be included in the explanation to demonstrate how each round would continue.
    - Weak answers merely explained how the assumed numerical examples led to a multiple rise in national income without linking it to economic growth (rise in national over time)..
    - The multiplier process stops when the total withdrawal (S + T + M) is equal to the initial injection (I) based on the numerical examples. This is also often missing.

Skills

- For AD-AS diagrams
    - For a rigorous explanation of the multiplier process and economic growth, the diagram needs to be well labeled and referenced in the explanation. Students that did not label and make reference to the horizontal axis (indicating Y_e and Y_f) would not be able to get the highest band of marks because changes in Y_e and changes in Y_f are crucial for explaining actual and potential growth respectively.
    - Weak answers failed to explain potential growth as a requirement. Other weak answers merely state instead of explain what happens. For example, "a rise in AD will lead to an unplanned fall in inventories" (state) versus "the rise in AD leads to a rise in unplanned expenditure … that leads to …" (follow through with the 'how' and 'why').
- There was also no need to explain why investment expenditure rose since it was given in the question. Some scripts brought in a fall in interest rates and proceeded to explain why it will lead to a rise in investment expenditure. While it was not wrong, students penalised themselves in terms of time.

Part (b)

R1: Discuss how EG can lead to higher SOL for residents in a country. **R2**: Discuss how EG may not lead to higher SOL for residents in a country. Ev: Weigh and evaluate points based on evaluative criteria (e.g. nature of country? Type of EG?) to answer the question.

Introduction

Standard of living (SOL) comprises both the material and non-material well-being. The material SOL (mSOL) is influenced by the consumption of goods and services, while the non-material SOL (nmSOL) refers to non-tangible aspects such as leisure, life expectancy, clean or stress-free environment.

Body

Thesis: economic growth will lead to higher SOL

[P] Economic growth leads to higher SOL for residents of a country due to a rise in purchasing power.
[EE] The rise in real national income from actual growth implies that there is a rise in the ability to consume more goods and services for households in the economy. For example, a rise in national income will enable a household to purchase a higher quantity of a good than before even though there is no change in the price of the good. With this greater ability, households are now also more able to consume a wider variety of goods and services.
[L] Hence, the rise in national income from actual growth allows households to consume more goods and services, leading to a rise in the mSOL.

[P] Economic growth leads to higher SOL for residents of a country due to improvement in redistribution
[EE] When national income rise, even by maintaining a constant tax rate, the government can redistribute incomes from the rich to the poor without the rich losing in absolute terms. As the income levels of residents rise, the government's tax revenue would correspondingly rise. This additional tax revenue for the government can be spent on programs to alleviate poverty. For example, the government would now be able to provide more subsidies or food vouchers to the needy. Overall, the benefits from the rise in national income is more widely distributed, especially for the poor.
[L] Hence, the rise in national income leads to a rise in the mSOL.

[P] Economic growth can leads to higher SOL for residents in a country due to improvement in living environment
[EE] With a higher level of national income, the tax revenue for the Govt will also rise, assuming the same tax rate. With these additional tax revenues, the Govt may spend more on public goods such as parks and gardens in additional to other amenities that promote a higher quality of life for residents. For example, more greenery may help mitigate poor air quality. This leads to a higher nmSOL for residents. With other public amenities like more and better school environment, the literacy levels also rise.
[L] Hence, the additional spending by the Govt on public and merit good leads to a rise in the SOL of residents.

Anti-thesis – economic growth may not lead to higher SOL

[P] The rise in national income from actual growth may not lead to higher SOL if it's due to a rise in production of capital goods / export revenue
[EE] When the economy is operating at spare capacity, the rise in the AD would lead to a rise in national income. However, if the rise in AD is due to a rise in expenditure on capital goods, there is no increase in consumption of goods and services for residents. There is only an increase in capital stock such as machinery and inventories of raw materials that would promote growth in the future.
In addition, if the rise in AD is due to a rise in export revenue, there is also no increase in consumption for residents in the country. Instead, the additional output from domestic production goes to the rise in consumption of foreigners.
[L] In these instances, the rise in national income does not lead to a rise in the mSOL for residents in the country

[P] The rise in national income from actual growth may not lead to higher SOL if the actual growth comes from workers working longer hours
[EE] A country's national output (income) can rise when workers put in more time into production of goods and services. However, the trade-off is the amount of leisure that these workers could have enjoyed which contributes to their nmSOL. For example, assume a worker is paid $10 an hour for working 10 hours a day. For every additional hour of work, this worker can earn an additional $10 but has to sacrifice the same hour of rest. Working beyond 10 hours a day will lead to a fall in the time for rest and hence a fall in the nmSOL.
[L] Thus, the fall in nmSOL may offset the rise in mSOL

[P] The rise in national income from actual growth may not lead to higher SOL if the growth does not take into consideration adverse environmental effects
[EE] The rise in national income comes from production processes that may pollute the environment or deplete natural resources. For example, if the manufacturing process results in the discharge of CO2 emissions or industrial waste into the river, it will negatively affect the air and nature in the

affected areas for residents in the country. The pursuit of such economic growth results in the degradation to the environment that affects the nmSOL of residents in the country.
[L] Hence, there will be a fall in the nmSOL

[OPTIONAL POINT]
[P] The rise in national income from actual growth may not lead to higher SOL if it is not well distributed
[EE] If the rise in national income from actual growth accrue only to certain sectors of the economy, other sectors' workers will not be able to enjoy a higher levels of consumption. For example, when there is economic growth that is driven by the healthcare sector, the income for workers in this sector will experience a rise while other domestic sectors may not increase. As such, while the national income per capita may suggest that on average, residents should experience an improvement in the mSOL, the poor are not actually enjoying that improvement in purchasing power.
[L] Hence, if the proportion of lower income and poor is very large in the country, then the majority of residents will not experience a rise in mSOL.

Synthesis / Evaluation / Conclusion

The level of development of a country will determine whether material consumption is more critical than non-material aspects of SOL.

Residents will consider nmSOL only when their mSOL is largely met. For example, if the residents are suffering from poverty, the more urgent need is to raise the mSOL. This is achieved through actual growth where the rise in national income will provide more for households to meet their material needs. As the national income rises, government tax revenues will also rise, which allows for more Govt expenditure to mitigate any negative effects from higher production. Examples of such intervention costs could include spending more on pollution monitoring and enforcement, subsides to promote green technology in production and preservation of nature as carbon sinks to absorb the CO2 emissions.

If the economic growth is broad-based, more residents will be able to enjoy the rise in purchasing power and hence, mSOL will rise. At the same time, if the growth is driven by highly pollutive industries, this mSOL may be offset by the nmSOL aspects in terms of poorer air quality. Hence, how the economic growth is achieved is also an important consideration.

Hence, economic growth may not always lead to higher SOL for residents in a country. It depends largely on the state of the economy that a country is currently operating in, level of development of a country and how the growth is achieved. Even as the mSOL rises, the nmSOL aspects should not be ignored in order for residents in a country to truly enjoy a higher SOL. In order for all the residents in the country to enjoy a higher mSOL, the benefits need to be more inclusive.

Mark Scheme

Level	Descriptor	Marks
L3	● Well-explained answer that demonstrates understanding of how economic growth (sustained, sustainable and inclusive) may not always lead to higher SOL for residents in a country	8 - 10
L2	● A good and thorough explanation of **either** how economic growth may or may not lead to a higher SOL for residents in a country	5 - 7

L1	● Demonstrates understanding of SOL ● Knowledge of concepts with little or no explanation of link between economic growth and SOL	1 - 4
E3	For an answer provides supported evaluative statements and arrives at an analytically well-reasoned and synthesized judgement about the link between economic growth and SOL	5
E2	For an answer that makes some attempt at supported evaluative statements about whether economic growth will always bring about a rise in SOL	3-4
E1	For an answer that gives an unsupported statement about whether SOL will always rise when there is economic growth	1-2

Markers' Comments

Content

- A handful of scripts stated that improved labour productivity (a reason for actual economic growth) leads to people working longer hours and thus lower leisure time. This is inaccurate as labour productivity is measured output per man hour, and thus working hours are accounted for.
- A minor point but a fair number of scripts explained how economic growth and thus increased income increases the willingness (should be ability) of households to consume big ticket items and luxury goods. From a micro-standpoint, increased income increases the ability of consumers to consume normal goods, rather than only big ticket items.
- A clear distinction should be made between households vs consumers in explaining the macroeconomic situation - we focus on the stakeholders (vs using consumers/buyers interchangeably).
- There is a clear distinction between indicators (GDP or GNI) versus concept (economic growth). Economic growth occurs when there is a rise in GDP over time. In addition, there were answers that mentioned the use of Gini coefficient (indicator) to measure SOL, which is not the requirement of the question.
- A key explanation of how economic growth leads to higher non-material SOL through higher tax revenue collected was very often missing. As a result, there were more arguments against economic growth.
- Material and non-material SOL were often not defined in the introduction. As such, answers tend to use SOL generally without making the distinction between the two in their explanation, which clearly shows a lack of rigour and precision.
- Students who explained that economic growth could improve/worsen unemployment often did not make the final link from unemployment to SOL. While the argument is valid, clear links to SOL should be drawn since the question is explicitly asking about SOL.
- The evaluative conclusion should not be a summary of the points made, as done so in many scripts. Students should be thinking more deeply about what situations or countries or criteria in which economic growth will lead to improvement/ worsening of SOL.

Skills

- Some students misinterpreted the question, and discussed and explained economic growth "overstated" or "understated" living standards. This is wrong as the question asks for cause (economic growth) and effect (SOL), and not indication of improved or worsened SOL.
- Hence, for students who suggested using better indicators such as GINI Coefficient and HDI in their answers, they did not answer the question of economic growth leading to higher SOL.
- Weaker answers were one-sided answers (ie. that argued economic growth may not lead to higher SOL) despite the command word "whether" (which requires an opposing view. In addition, for those who recognised that need, a good response would be to show how economic growth could lead to higher mSOL and nmSOL before going on to explain how it may not.
- The use of appropriate examples would help improve the clarity and expressions used in the explanation, especially for those who may be weaker in writing fluency.