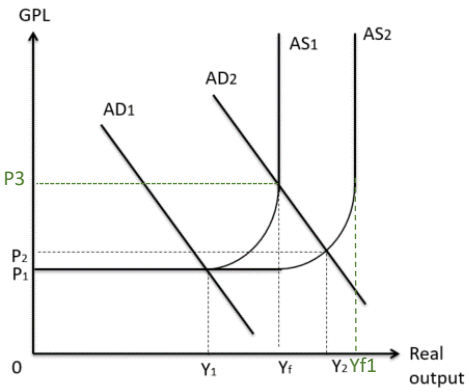
Question 2: Innovation is the key to prosperity in an age of new technologies

(a)	**Distinguish between a rise in total output and a rise in productivity. [2]**
	A rise in total output refers to an increase in the overall value or level of final goods and services produced in an economy [1] whereas a rise in productivity refers to an increase in the output per man-hour [1].
(b)	**Explain one reason why a firm with significant market power and long-run excess profits might choose to spend large sums on research and development (R&D). [2]**
	Any one possible reason (with or without evidence) is acceptable. **Contestability** Based on the contestable market theory, the firm may engage in R&D due to the threat of potential competition. For instance, with more "localised production" (Extract 6), there could be transference of knowledge and technology, allowing potential new players from China and US to compete in car manufacturing. Hence, incumbent firms may engage in process innovation to lower their costs of production and remain price competitive relative to their potential competitors, thus allowing them to retain their supernormal profits and their market share. *Alternative: Product development to keep the firm's AR high and relatively price inelastic, allowing them to continue charging high prices without losing revenue, and thus their supernormal profits.* ***OR*** **Government Regulation** The firm may engage in R&D due to government regulation. For instance, if the fines incurred (Extract 6) due to production of traditional cars significantly reduces the car maker's supernormal profits, the car maker may find it more profitable to engage in R&D and switch to producing electric vehicles. Though expensive in the short term, such successful product development may keep the firm's DD/AR high and relatively price inelastic, ensuring high revenue without having to pay fines. Thus, this may increase the firm's overall profits.
(c)	**Explain, with reference to Extract 8, what might be the opportunity cost of the $19 billion invested by the Singapore government to build the country into a global R&D hub. [2]**
	"Although it has an abundance of capital, Singapore has faced talent shortages…" (Extract 8) suggests that the $19 billion invested in infrastructure and technologies could have resulted in less funds allocated for skills training and education. Hence the opportunity cost which is defined as the value of the next best alternative forgone [1] could be the potential investment revenue for Singapore because of more training and skills upgrading of local talent that is foregone. [1]

	Any other potential area of government expenditure is also acceptable as the next best alternative foregone
(d)	**Explain how the creation of an innovation culture in Singapore is likely to have benefited the Singapore economy. [6]**
	The creation of an innovation culture has led to a rise in government expenditure (G), as well as influx of foreign direct investments (I). Investments in advanced technology sectors having made Singapore a base for high-end manufacturing would have also increased the value and demand of exports, and thus export revenue (X). **<u>Actual Growth:</u>** <u>Explain macro adjustment process (ISSUE):</u> *[Initial equilibrium]:* As shown in the diagram below, assuming the economy is operating with limited spare capacity and the initial equilibrium is at E_1. The initial GPL and real output are at P_1 and Y_1 respectively. *[Shift in AD]:* An increase in AD arising from a rise in G & I would cause total spending to exceed total output, resulting in a shortage at the original GPL P1. *[Adjustment process]:* This leads to a fall in inventories which provides an incentive for producers to step up on production to meet demand. As there is limited spare capacity in the economy, and because producers hire more factors of production, this will bid up factor prices, leading to a rise in GPL. The hiring of factor inputs like labour will reduce demand-deficient unemployment too. There is a movement along the AD and AS curve. The rise in income arising from the initial rise in AD causes a rise in income-induced consumption that results in a further increase in AD. As one's spending becomes another's income, there will be a multiple increase in AD until a new equilibrium is reached at E_2 where $AD_2 = AS_1$. Real output increases by a multiplied amount from Y_1 to Y_2. *[State the multiplier effect]:* The rise in real output will be by a multiplied amount due to the working of the multiplier where one's spending becomes another's income. In the case of limited spare capacity, the reduced/ dampened multiplier effect will occur. *[Link to economic growth & lower unemployment]:* Actual growth occurs and is represented by the increase in real output from Y_1 to Y_2. Lower unemployment also results due to lower demand-deficient unemployment.



Potential growth:

In the long run, the rise in G and I would have also led to more advanced technology, increase in capital investments via capita accumulation and a more productive workforce. The rise in quantity of capital goods, quality of labour and state of technology leads to increase in productive capacity of the economy. Aggregate Supply (AS) shifts to the right from AS1 to AS2, and potential growth is achieved as illustrated by the rise in the full employment level of output from Yf to Yf1. As shown in the diagram above, given that AD is sufficiently high, there would be further increases in real output from Yf to Y2 resulting in further actual growth, and a fall in GPL from P3 to P2, keeping inflation low and stable.

Address the question on benefits to Singapore economy:

The continual rise in real output and stable GPL suggests **sustained economic growth (with a rise in actual and potential growth)** for the Singapore economy. If the rate of increase in real national income outweighs the rate of population growth, there would be a rise in real income per capita, and hence the average citizen's ability to consume more goods and services. Material well-being increases, **improving standard of living**, ceteris paribus.

The rise in export revenue, ceteris paribus would have contributed to a **healthier balance of trade** as trade surplus increases.

Shift in AD – 2m
Shift in AS – 2m
Impact on SG – 2m
Diagram is not required for this question

(e)	**Discuss whether subsidising the purchase of electric cars would improve the efficiency of resource allocation in the market for transport in Singapore. [8]**

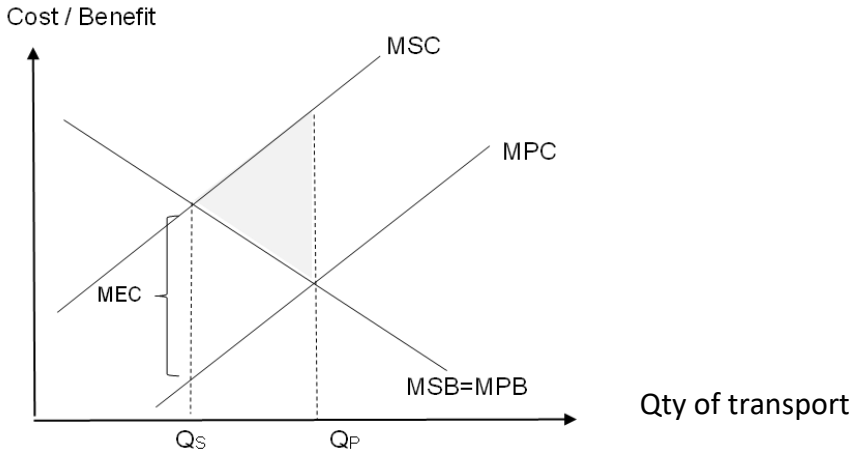
Introduction:

Governments aim to maximise societal welfare, and in this context, achieve microeconomic goals such as efficiency and equity.

Body / Development 1:

Market failure in the transport market

Negative externalities in production refer to the harmful effect on third parties resulting from the production of a good or service, which are not compensated for. In this context, as suggested by Extract 5, transport via petrol- and diesel-powered vehicles generates negative externalities. Pedestrians incur medical costs from breathing in air that is polluted by the exhaust from petrol and diesel cars. In addition, traffic congestion also causes allocative inefficiency in the transport market as it generates 3rd-party cost in the form of reduced profits of firms due to reduced productivity of employees who are late for work or miss deal closure meetings due to congestion. The negative externalities present result in the marginal private costs (MPC) being lower than the marginal social costs (MSC). The private optimal output Qp occurs at MPC=MPB which is higher than the socially optimal output Qs at MSB=MSC. As a result, there is overconsumption and overproduction of QpQs amount of transport. Deadweight loss of the shaded area is incurred. There is an overallocation of resources in the market for transport. Thus, there is a need for government to intervene, and in this context, it is subsidising the purchase of electric cars to improve the efficiency of resource allocation in the market for transport in Singapore.



Body / Development 2:

[How policy works] How subsidies for purchase of electric cars would improve the efficiency of resource allocation

Electric cars can be seen as substitutes to petrol and diesel cars. Subsidies for electric cars would lower the unit cost of production, resulting in higher potential profit per unit and supply of electric cars to increase, ceteris paribus. Equilibrium price of electric cars decrease, and consumers of petrol and diesel cars may

switch to purchasing electric cars instead. This leads to a fall in demand for petrol and diesel cars, resulting in less use of petrol and diesel cars. Thus, the problems related to the pollution from exhaust fumes will decrease, reducing the negative externalities generated from transport. MEC decreases, and MSC moves closer to MPC. Socially optimal output increases, reducing the overproduction and overconsumption of transport. Deadweight loss due to overallocation of resources will decrease. Thus, this would improve the efficiency of resource allocation in the market for transport.

[How well policy works – any 1 point]

1. The policy is effective as it targets one of the root causes of inefficient resource allocation in the transport market – negative externalities arising from pollution and GHG emissions from transport using petrol- and diesel-powered cars. **[E/Criterion: Root Cause]** However, traffic congestion also causes pollution and GHG emissions to accumulate at hazardous levels – a higher concentration of pollution and GHG emissions arise due to longer times spent by petrol- and diesel- powered vehicles on the road. As subsidies on electric vehicles do not reduce the number of vehicles on the road, congestion persists and so GHG emissions arising from non-electric vehicles especially those which are not substitutes for electric cars like coaches, buses, trucks and other heavy-duty vehicles will continue since their demand is unaffected by the fall in price of the subsidised electric cars. This reduces the effectiveness of the policy to reduce allocative inefficiency in the transport market.

   Moreover, since subsidies for electric vehicles do not reduce the congestion which is also a source of allocative inefficiency in the transport market, they are not effective in reducing allocative inefficiency in the transport market arising from traffic congestion.

2. The effectiveness of the above policy to improve efficiency of resource allocation in the transport market also depends on the degree of substitutability between electric cars and petrol- and diesel- powered cars.
   [E/Criterion: Context/Degree of substitutability] Extract 5 suggests that subsidies alone may not be sufficient as price of electric cars are deemed to be still too high. Electric cars may not be perceived as close substitutes of conventional petrol and diesel cars as they are deemed as more “luxurious” and “expensive” forms of private transport.

   Hence XED value is likely to be positive but low. A decrease in price of electric cars will lead to a less than proportionate fall in demand for conventional cars, ceteris paribus. Hence, transport may still largely be via conventional cars, resulting in negative externalities arising from GHG emissions and pollution to be reduced by a limited extent, reducing the effectiveness of electric car subsidies to improve efficiency in the transport market.

[Alternative reason for why EVs and Non-EVs are poor substitutes:
Current electric cars may be seen as poor substitutes to conventional cars because of the hassle of maintenance and lack of complementary facilities. Extract 5 suggests battery technology is still developing hence energy efficiency of batteries may be limited. Hence electric cars may require more frequent and longer charging. While petrol stations are easily available in Singapore, charging stations for electric vehicles may be less common and not as easily accessible. Considering these inconveniences, the demand for conventional cars may persist even if electric vehicles are subsidised. This is because there is a still a favourable taste and preferences towards conventional cars.]

Synthesis & Evaluative Conclusion *[for How well it works pt. 2]:*
(Criterion: Government Intervention, Time)
All in all, whether subsidising the purchase of electric cars may improve the efficiency of resource allocation in the transport market depends on the extent of government intervention and time period ***(Criterion)***. While the above analysis suggests that **subsidising electric vehicles alone may not improve resource allocation immediately** in the market for transport in Singapore ***(Opinion)***, however, given Singapore government efforts in technological advancement and research and development (Extract 8), it is highly plausible that electric vehicles may become more affordable and durable soon ***(Reasoning)***. With better battery technology and more accessible complementary features for ease of use and maintenance, electric vehicles may eventually become a more affordable and closer substitute to conventional cars, thus reducing the inefficiency in resource allocation.

Alternative Synthesis & Evaluative Conclusion *[for How well it works pt. 1]:*
(Criterion: Root Cause)
The above analysis suggests that **subsidising electric vehicles alone may not improve resource allocation** in the market for transport in Singapore ***(Opinion)*** as it only targets allocative inefficiency arising from pollution and GHG emissions generated by non-electric cars, but not other causes of allocative inefficiency in the transport market ***(Criterion).*** In order to address the allocative inefficiency in the transport market arising from congestion, it will be necessary to also provide subsidies for public transport such as buses to make them more affordable so that consumers will switch to using these large-capacity vehicles hence reducing the number of vehicles on the road ***(Reasoning)***. Finally, as technology improves and stabilises and the production of electric buses and electric heavy-duty vehicles is possible, the government could also provide subsidies for these so that consumers of their petrol- and diesel-powered counterparts would switch to them and so generate less negative externalities arising from pollution ***(Reasoning).*** These policies together will be more effective in address allocative inefficiency in the market for transport than electric vehicle subsidies alone. ***(Opinion)***

Mark scheme:

Level	Knowledge, Skills, and Application	Marks
L2	Well-developed and balanced discussion on whether subsidising the purchase of electric vehicles would improve the efficiency in resource allocation.	4-6
L1	For an underdeveloped answer that is one-sided OR lacks in-depth explanation on how subsidising the purchase of electric vehicles would improve or not improve the efficiency in resource allocation.	1-3
Evaluation	Well-reasoned judgement on whether subsidising the purchase of electric vehicles would improve the resource allocation in the market for transport in Singapore.	1-2

(f) Discuss the extent to which government policy can influence a country's comparative advantage in a good or service. [10]

Introduction

A country is said to have comparative advantage in a good or service if it can produce it at a lower opportunity cost relative to other countries. Based on the Theory of Comparative Advantage, the difference in comparative advantage stems from countries having different factor endowments which can be influenced by government policies.

Body/ Development 1

[How Govt Policy 1 influences a country's CA]

Government policy such as pro-business policies and interventionist supply-side policies can enhance a country's factor endowments and hence influence its comparative advantage.

For instance, Extract 8 mentioned that the Singapore's government has invested in a range of new technologies and also created a pro-business and pro-research environment with a trained workforce and protection of intellectual property. The increase in government expenditure on technologies would have improved the state of technology, while increase in investments from foreign technology firms and research and development (R&D) firms would help to increase capital goods better suited for high-end manufacturing and research, in addition to enhancing the state of technology in Singapore. Productivity level increases, and unit costs of production for high-end manufactured goods, tech-related goods and services, as well as research, decreases. There is an increase in supply of such goods and services and price of such goods and services decreases, making them more price competitive relative to that of other countries, ceteris paribus.

Singapore is thus able to produce such goods and services at a lower opportunity cost and gain comparative advantage in these areas, seeing how it has

successfully made itself an innovation and start-up hub in the region and a magnet for foreign technology (Extract 8).

[How well policy influences country's CA]

1. Government financing alone may result in high opportunity costs incurred due to budget reallocation, as the government would have to reduce spending in other key areas like education or healthcare, to support the investment in technology and R&D. in the case of a budget deficit, the government may have to resort to borrowing to finance the spending, leading to the possibility of debt incurrence and hence higher taxes imposed in the long run, which may result in disincentive to work, save and invest – extinguishing the very impetus for the development of comparative advantage. **Hence factors such as costliness of policy particularly in the case of countries with tight budgets could reduce the influence of government policy over a country's comparative advantage.**
   [E/Criterion: Context] However, such a constraint might not affect as much a country such as Singapore. Budgetary prudence has led to accumulated reserves which the government could tap on to finance these policies, reducing the need to borrow and raise taxes in future. Hence policy costliness has less impact on the influence of government policy over Singapore's comparative advantage.
2. Moreover, while government policies can ensure a pro-business environment, the funds needed to acquire advanced technology and conduct research may be very high. Firms may be constrained by the availability of their own funds, and thus despite the positive business environment created by the government, investments in innovation and technology may be slow, limiting the impact on comparative advantage of a country.
   [E/Criterion: Context] For instance, the German car industry's plans to shift its focus to battery-powered cars may be constrained by the lack of funds due to slowing demand and falling revenue (Extract 6). This could curtail government efforts in devoting 'a third of R&D spending' (Extract 7) in the car industry to help Germany improve its R&D and innovation competitiveness. **Hence the extent to which government policy can influence a country's comparative advantage can be limited in this case by the availability of the firm's own financial resources.**

<u>Body/ Development 2</u>

[How Govt Policy 2 influences a country's CA + How well policy influences country's CA]

In addition, comparative advantage is not only influenced by the quantity and quality of capital goods and state of technology. Other resources like land and labour i.e., a country's factor endowment also play a significant role. Extract 7 suggests that the quality of labour is also key in determining the success of innovation. While a government can focus its effort on upgrading the country's education system and encourage upskilling with the aim of improving productivity in high-end value-added manufacturing and therefore acquire comparative

advantage in such goods by lowering the opportunity cost of producing them, the outcomes of these policies are also highly dependent on the receptivity of labour and employers. If labour lacks the aptitude and right attitude, they may not be able to harness the full benefits of quality education and training and hence may be inadequately trained to operate advanced machinery and conduct research. Employers may also be reluctant to lose man-hours and limit the opportunities for workers to upgrade their skills. Thus, **the quality of labour i.e., a country's factor endowment could limit what government policies can do to influence a country's comparative advantage.**

Synthesis (Criterion: Nature of government intervention)
Overall, whether government policy can influence a country's comparative advantage in a good and service depends on the nature of government intervention i.e. how and in which areas the government intervenes ***[Criterion]***. Government policy can have a very large influence on comparative advantage if the government is able to correctly identify the sectors in which the country is likely to have potential comparative advantage in, and policies put in place complement one another very well. This, in turn, is dependent on the availability and extent of information that the government possesses. If the government has little information, it may be prone to government failure as it might not be able to accurately identify these sectors, which may subsequently not only lead to a misallocation of resources, but also fail to develop a comparative advantage in the identified industry. ***[Reasoning]***
[Contextualise] For instance, in the case of Singapore, government policy not only looks at motivating businesses to invest, but also ensures high tertiary-education efficiency (Extract 7) to overcome the challenges posed by a small labour force. In ensuring a coordinated approach between universities and private companies, the workforce is equipped with relevant and updated skills to complement the economy's shift towards high-tech and high-end manufacturing. On the other hand, Germany has been spending a lot on R&D in the car industry, despite increasingly localised production by car makers in China and US (Extract 6). Instead of being overly focused on the car industry which might eventually be overtaken by that of other countries, government policy could look at retraining and R&D spending in other areas of potential comparative advantage such as the services sector. ***[Opinion]***

Mark scheme:

Level	Knowledge, Application, Understanding & Analysis	Marks
L2	Well-developed and balanced discussion on how government policy can influence a country's advantage and its limitations and/or other factors that influence a country's comparative advantage	4-7
L1	For an underdeveloped answer that is one-sided OR a descriptive answer that lacks rigour in explaining how	1-3

		government policy may or may not influence a country's comparative advantage. No/very limited reference to case evidence.	
	Up to 3 additional marks for evaluation		
	E2	Well-explained judgement on the extent to which government policy can influence a country's comparative advantage.	2-3
	E1	For unexplained judgement or mere statements without elaboration.	1