

3 To ensure the success of vaccination as a tool in COVID-19 pandemic prevention and control, a high vaccination rate in a country is required. However, despite the vaccines being provided free of charge, vaccine hesitancy is still prevalent in some countries due to the spread of misinformation.

(a) Explain how consumers act rationally to decide whether to take the COVID-19 vaccine and the likely impact of their decisions on resource allocation in the COVID-19 vaccine market. [10]

(b) Discuss how government intervention in the market for vaccines could lead to social welfare being maximised and consider how likely such intervention will achieve this aim. [15]

Suggested Answer

Part (a)

Introduction

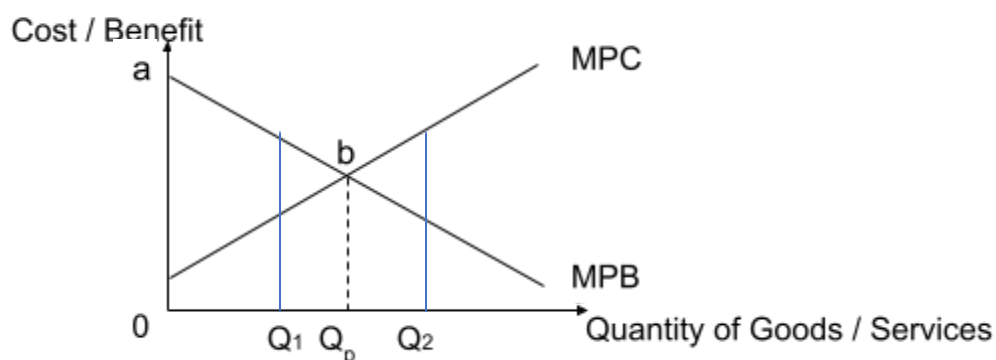
A rational consumer seeks to maximise his satisfaction or net benefit. In deciding whether to consume a good, the consumer will apply the marginalist principle and consider the marginal private benefit (MPB) and marginal private cost (MPC) of consuming the good. The MPB reflects consumers' additional benefit (i.e. satisfaction or utility) from consuming the last unit of the good / service. The MPC reflects consumers' additional cost to consume the last unit of good / service.

How consumers act rationally to decide whether to take vaccine

The consumer will take his MPB and MPC into account in deciding whether to take COVID-19 vaccine. The MPB of consuming the vaccine is the protection and savings on medical costs he enjoys due to lowered chances of falling ill after being infected with the virus and minimizing the risk of spreading the virus to his household. The MPC is the cost of vaccination incurred. Other than the explicit cost, i.e. the price of the vaccine, it also includes the opportunity cost, the next best alternative forgone in terms of other goods, e.g. food, he could have purchased with that amount of money. He could also have spent the time allotted for the vaccination on other activities like watching a movie instead.

With reference to Figure 1, if his MPB higher than MPC, at Q_1 , the consumer will proceed to take the vaccination. However, if his MPB is less than his MPC, at Q_2 , the consumer will decide not to take the vaccination. Hence, the consumer will consume up to the point where $MPB = MPC$ at Q_p . At this point, the consumer maximises his net benefit as seen by the area abc.

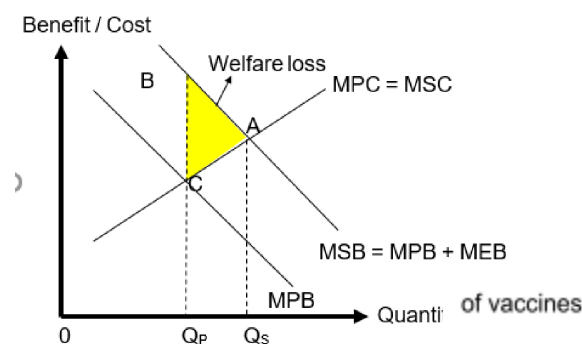
Figure 1: Private optimum output



How positive externalities can lead to under-allocation of resources

However, consumption of the vaccination generates positive externalities, which third party can enjoy (external benefit) as well. Vaccinations help prevent the spread of viruses to the community at large. Those in the community are now less likely to be infected as there is one less person who has the potential to transmit the virus. The community will benefit from saved medical expenses, and the economy benefits since less man-hours is lost to workers being ill. This external benefit is not taken into account by the consumers in their decision making as they only consider their MPB. The existence of marginal external benefit (MEB) results in a divergence between MPB and the marginal social benefit MSB as seen in the diagram above, where the MSB lies above the MPB, with the vertical distance between MPB and MSB representing MEB. The socially optimal output, Q_s , is where $MSC = MSB$. Between Q_p and Q_s , $MSB > MSC$. As such, at output Q_p , society values an additional unit of vaccination more than what it would cost society. Society desires more consumption of vaccination, hence, when the decision is left to the market, there is under-consumption of vaccination by $Q_p Q_s$ amount or there is an under-allocation of resources. By summing the excess of MSB over MSC for the units $Q_p Q_s$, we arrive at a monetary measure of welfare loss (also known as deadweight loss) of area ABC to the society.

Figure 2: Presence of positive externalities



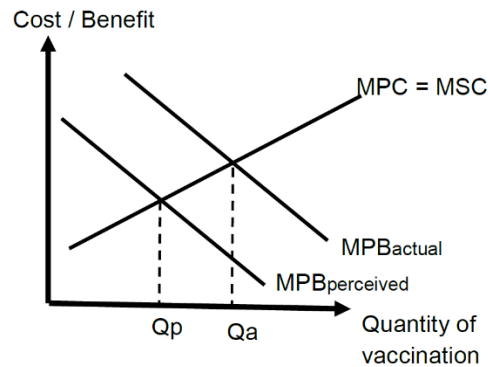
How under-valuation of MPB can lead to under-allocation of resources

In addition, due to imperfect information, consumers might not have an accurate valuation of their MPB as they are not fully aware of the benefits (to himself) of getting vaccinated as they get to avoid the potential complications caused by the viruses. Therefore, consumers may under-estimate the actual marginal private benefit (MPB_{actual}) of getting vaccinated, resulting in a perceived marginal private benefit ($MPB_{perceived}$) that is lower than MPB_{actual} . With accurate valuation of the MPB, quantity of vaccination consumed would be at Q_a . However, consumers are consuming at output level Q_p . Hence, there is an under consumption of vaccination due to imperfect information and there is under-allocation of resources in the market for vaccines.

(Note:

Alternatively, it is also possible to analyse that inefficient allocation of resources arises from $MPC_{\text{perceived}}$ being higher than MPC_{actual} .)

Figure 3: Presence of imperfect information



Conclusion

A rational consumer would weigh his MPB against MPC in deciding whether to take the vaccine as his aim is to maximise his own net benefit. However, such a process might not generate an outcome that is socially optimal as the consumers' valuation of his private benefit might not be accurate or does not take into the external benefit, resulting in the MPB being lower than the MSB. As a result, there is under-consumption and under-allocation of resources in the market.

Suggested Mark Scheme

Level	Knowledge, Application, Understanding and Analysis	Mark
L3	For an answer that demonstrates developed explanation on how a rational consumer decides whether to consume vaccine using the marginalist principle and resource allocation in the vaccine market is inefficient due to the presence of positive externalities or imperfect information.	8 - 10
L2	For an answer that demonstrates underdeveloped explanation on how a rational consumer decides whether to consume vaccine using the marginalist principle and resource allocation in the vaccine market is inefficient due to the presence of positive externalities or imperfect information. Max 5 marks: A one-sided answer that explains how a rational consumer decides whether to consume vaccine using the marginalist principle. Or	5 - 7

	A one-sided answer that explains how the allocation of vaccine is inefficient due to the presence of positive externalities or imperfect information.	
L1	For an answer that shows limited knowledge of rational decision making and market failure and contains major concept errors in understanding and shows lack of coherence.	1 - 4

Part (b)

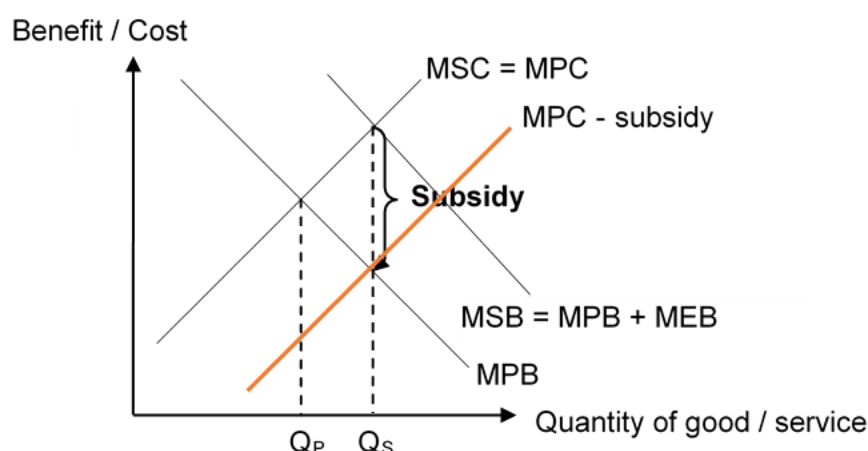
Introduction

As there is under-allocation of resources in the vaccine market, government intervention is required in the market to ensure that there is efficient allocation of resources so that welfare to society can be maximized.

How subsidies work to achieve efficient allocation of resources

Subsidies is a policy which could be used to tackle market failure in the vaccine market.

Figure 4: Effect of subsidy



With reference to Figure 4, the government can provide a per-unit subsidy that is equal to the MEB at the socially optimal level of output, Q_S . The amount of per-unit subsidy is equal to the vertical distance of MEB (Distance between MSB and MPB_{actual}) at Q_S . The subsidy provided has the same effect as decreasing the unit cost of consuming the vaccine. Thus, the subsidy shifts the consumer's MPC vertically downwards by the full amount of the subsidy to coincide with MSC . This is illustrated by $MPC - subsidy$. If the subsidy is calculated to accurately reflect the MEB at Q_S , consumers will consider the true social benefit of consuming the vaccine and increase consumption to the socially optimal level Q_S . Thus, allocative efficiency is attained.

How effective is subsidy

Subsidies aim to tackle the root cause, presence of positive externalities of under-consumption. This is because through rational decision making in the free market, producers and consumers ignore external benefits and only account for their self-interests by considering private benefits and costs. A subsidy is effective since it targets this root cause as these external benefits are internalised.

If amount of subsidy imposed is correctly estimated to reflect monetary value of MEB generated, the amount of vaccines consumed or produced in market will coincide with the socially optimal level. However, this requires an accurate estimation of the MEB. Under-valuation of MEB implies that although consumption of the vaccines is increased by the given subsidies, it is not sufficient to bring output to the socially optimal level to maximise society's welfare. An over-valuation of the MEB implies that although output is increased, it will result in over-consumption and welfare is again not maximised. However, this does not seem to be the concern of some governments as their purpose is to encourage all those who are eligible to consume by giving full subsidization of the vaccine.

(Note:

Alternatively, it is possible to argue that MEB in this case is so large that it justifies a full subsidization by the government.)

How public education works to achieve efficient allocation of resources

However, despite full subsidization of the vaccine there are some who are still reluctant to take the vaccines. Hence, there is still a need for the government to embark on education campaigns to correct the imperfect information in the market for the vaccines. Education campaigns aim at making consumers more aware of the full benefits of consuming the vaccines to themselves. Hence, consumers' perceived benefits increase to the level of actual benefits. For instance, there are advertisements in different languages put up on various platforms by the Singapore government to encourage Singaporeans to take the vaccines. With public education by the government, consumers perceive the benefits of consuming the vaccines becomes higher, thus narrowing the gap between the perceived and actual benefits of vaccination.

With reference to Figure 3, if such public education campaigns are successful, the private benefit for health care services would increase from $MPB_{\text{perceived}}$ to MPB_{actual} which will cause consumption to increase from $Q_{\text{perceived}}$ to Q_{actual} , reducing the extent of underconsumption and reducing the extent of market failure.

How effective is public education

Education campaigns target the root cause of imperfect information and is hence likely to be effective in reducing the extent of underconsumption. However, its effectiveness depends on receptiveness of the public to the content of the education campaigns thereby causing the outcomes from public education to be uncertain.

There could also be a possibility whereby education campaigns convinced the mass of the importance of the external benefits of healthcare services and alter their decision-making process in the long run. For instance, they could be convinced of the external benefits of 'herd immunity' and integrate it into their valuation of benefits. This could increase the MPB of consuming vaccination, thereby increase the equilibrium quantity of vaccination consumed to the social optimal level.

Due to the time taken to educate the mass it is likely to be more effective as a long-term preventive measure. However, given the nature of the pandemic, governments would need to boost the take-up rate of the vaccines substantially over a short period of time.

However, the effectiveness of this measure can be affected by the extent of the spread of misinformation. If it has caused a large information gap, resulting in a greater divergence between MPB_{actual} and $MPB_{perceived}$, then it is unlikely to be sufficient to address the issue of imperfect information. In such cases, the use of legislation to curb the spread of misinformation might be necessary to ensure that the information gap can be closed, thereby reducing the extent of the deadweight loss and increasing social welfare.

How regulation works to achieve efficient allocation of resources

The government might need to implement other measures like regulation. For example, in Singapore, the government put in place a regulation that only those who are vaccinated are allowed to enter public places like the shopping malls. This is similar to vaccine passes implemented in other countries to encourage more of their citizens to get vaccinated more quickly. By doing this, it will raise MPC relative to the MPB if one does not get vaccinated or increases the MPB relative to the MPC if one gets vaccinated. This then incentivizes the rational consumer to make the decision to get vaccinated after weighing their MPB against their MPC. With higher consumption of the vaccines, the output can move closer to the socially optimal level, increasing social welfare.

How effective is regulation

For regulation to be effective, strong enforcement on the part of the government is required. The necessary mechanism for monitoring and checking for compliance by the public has to be in place. There should also be stiff penalties imposed for non-compliance. Hence, the effectiveness of this policy is subjected to whether the government has sufficient resources and the ability to ensure that appropriate punishment can be meted out to those who do not comply. For countries that are able to do so will likely be able to increase consumption of the vaccine sufficiently thereby increasing social welfare.

(Note:

Alternatively, legislation to address the spread of misinformation is another example that can be used.)

Conclusion

While government intervention in the form of subsidy and public education can be implemented to address the problems of positive externalities and imperfect information, the effectiveness of these measures in achieving efficient allocation of resources are dependent on various factors, like the ability of the government to estimate to MEB and willingness of the public to change their mindset. However, timing is an important consideration in this context. Given the urgency in controlling the spread of the virus,

these measures are not sufficient and many governments adopted additional measures like regulation to boost take-up rate of the vaccines quickly.

Suggested Mark Scheme

Level	Knowledge, Application, Understanding and Analysis	Mark
L3	For an answer that is well developed with the use of economic analysis to explain how at least two policies can be used in the vaccine market to achieve efficient allocation of resources and consider the factors that affect the effectiveness of the measures.	8-10
L2	For an underdeveloped answer that explain how the policies can be used in the vaccine market to achieve efficient allocation of resources and consider the factors that affect the effectiveness of the measures. Max 6 marks: A one-sided answer that is well developed with the use of economic analysis to how a policy can be used in the vaccine market to achieve efficient allocation of resources and consider the factors that affect the effectiveness of the measure. Or A one-sided answer that is well developed with the use of economic analysis to explain how two policies work to achieve efficient allocation of resources.	5-7
L1	For an undeveloped answer that shows some knowledge of the policies or some of their limitations. Answers may contain conceptual errors.	1-4
Evaluation		
E3	For an answer that uses economic analysis to support evaluative comments about whether the policies would achieve efficient allocation of resources to maximise welfare to society.	4-5
E2	For an answer that gives a stand with some support on whether the policies would achieve efficient allocation of resources to maximise welfare to society	2-3
E1	For an answer that gives a judgement without substantiation.	1

