## 2022 A Level H2 Economics, Paper 2 EQ3

Street lighting is considered to be a public good. However, there are also negative externalities resulting from the generation of electricity for the lighting on the environment and the effect of bright street lights on wildlife.

(a) Explain two different reasons for the market failure associated with the provision of street lighting. [10]
(b) Discuss the extent to which a government should intervene in the market to ensure that the benefits of street lighting can be obtained while minimising the negative impacts. [15]

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## Suggested answer (a)

Introduction

- Market failure describes the circumstances in which distortions in the markets prevent the price mechanism from allocating resources efficiently, resulting in welfare loss.
- In the case of street lighting, it is generally not provided, i.e. public good, or considered to be overprovided in the free market due to the presence of negative externalities.

Development

**Requirement 1: Public good**

- Street lighting is both non-rivalrous and non-excludable.
- Non-rivalrous: Consumption of the good by one person does not diminish the quantity available for consumption by another person. The property of non-rivalry means that once the good is provided, the additional cost to provide for another person to benefit from consuming the good is zero. In this context, the brightness of street lighting available to the next user will not reduce when one consumes/ passes by. Hence, the marginal cost of providing street light to one more person is zero. If the marginal cost is zero, the efficient price to charge should be zero (P = MC). If a price was charged, there would be a welfare loss to society. But no private firms who are assumed to be profit-motivated would be willing to supply street light if the price is zero, resulting in zero supply of street lights.
- Non-excludable: It is impossible, or prohibitively costly (not feasible) to exclude anyone from using the good once it is produced. The property of non-excludability gives rise to the free rider problem. Individual can free-ride on street lighting and utilize the lighting once it is installed without having to pay for it. The desire to be a free rider weakens the incentive for consumers to offer to pay for street light. Hence, no rational consumer will demand for street light, resulting in no expression of demand. Since there is no expression of demand, it is not possible to charge a market price for street light if the public good itself is left to the private firms.

- As a result, if street lightings are left to the market, they would not be provided at all. There is hence a missing market for street lighting, thus leading to complete market failure. The market has failed because no resources will be allocated to their production.

**Requirement 2: Good that exhibits negative externalities**

- Negative externalities arise from the generation of electricity used for street lighting.
- Steps to explain negative externalities as a source of market failure:

**1. Private (or Market) output (MPB=MPC)**

In a free market, the price mechanism will only consider private costs (costs of production for electricity) and benefits (revenue from electricity generation), ignoring externalities. The individual producer will produce up to the output level, Q where MPB intersects MPC. Private welfare is maximised.

**2. Divergence between MSC and MPC: Explain MEC in context**

Individual decision makers are not internalising all the costs that society is bearing. External costs of production (or consumption) are imposed on some third party adversely for which no compensation is being provided for. For example, the medical costs incurred by non-users who are affected by air pollution due to harmful gases emitted during the generation of electricity for the street lighting.

> ***Alternative:*** *These lights disrupt nocturnal activity, interfering with reproduction and reducing populations of wildlife, which may lead to wildlife researchers having to incur additional costs to create conducive environment for them to thrive and reproduce.*

The presence of the marginal external cost (MEC) that arises from the existence of the negative externality causes the divergence between MPC and MSC where MSC>MPC. It is assumed that there are no positive externalities and thus MPB = MSB.

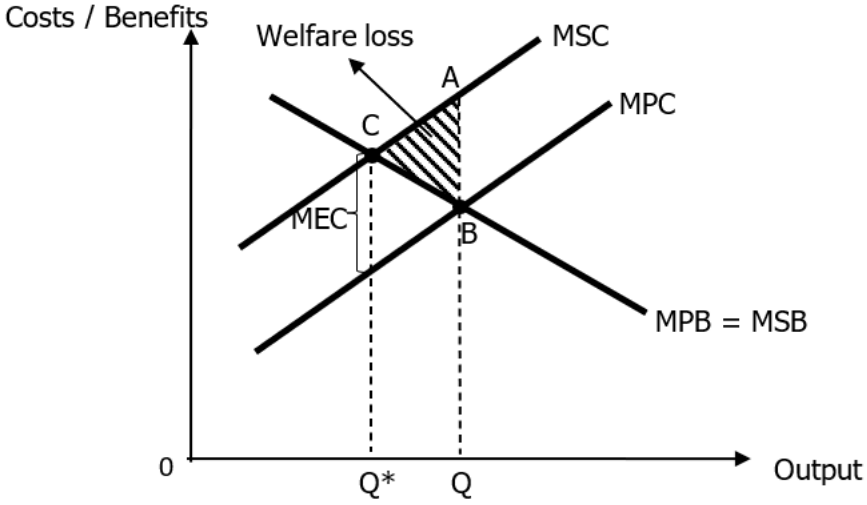


Figure 1: Divergence between MSC and MPC due to negative externalities

**3. Socially optimal output (MSB=MSC)**

The socially optimal output will be at Q* where MSB intersects MSC where society's welfare is maximised.

**4. Allocative inefficiency: Over-production or over-consumption**

At Q, the MSC is greater than the MSB. This means that the last unit of output adds more to society's costs than it will to society's benefits. Hence, the price mechanism over-allocates resources to the production of the good, leading to an by Q*Q units.

**5. Deadweight loss to society**

With reference to Figure 1 above, the deadweight loss is indicated by area ABC and is the difference between total social costs (area Q*CAQ) and total social benefits (Q*CBQ) of the additional Q*Q units being overproduced. The market fails because allocative efficiency has not been achieved at Q as resources can be re-allocated to increase society's welfare. Thus, by decreasing production to output Q*, society can avoid the welfare loss.

<u>Conclusion</u>

- Since market fails in the provision of street lightings, there may be a need for government to intervene to ensure an optimal amount is being provided.

| Level | Knowledge, Application/Understanding and Analysis | Marks |
|---|---|---|
| L3 | • For a well-developed analysis on two reasons for market failure, with the use of well-labelled and well-explained diagrams where appropriate. | 8 – 10 |
| L2 | • Relevant answer but theory may be incompletely explained.<br>• Attempts to apply market failure concepts but lacks analysis.<br>• Explains only one possible reason for the market failure. | 5 – 7 |
| L1 | For an undeveloped answer that<br>• is descriptive, lacking in application of economic theory, and/or<br>• contains serious and pervasive conceptual errors, and/or<br>• is largely irrelevant. | 1 – 4 |

**(b) Discuss the extent to which a government should intervene in the market to ensure that the benefits of street lighting can be obtained while minimising the negative impacts. [15]**

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**Suggested answer (b)**

Introduction

- As seen in part (a), the market for street lighting failed to allocate resources efficiently as there could be problem of no street lighting produced at all as it is a public good and there is presence of negative externalities related to electricity generation and impact on wildlife.
- All governments aim to achieve the microeconomic objective of efficiency in resource allocation to maximise society's welfare – in this case, maximise the benefits of street lighting while minimizing the negative impacts. Hence government's objective is to ensure the provision of street lighting at the socially efficient level, and it can do so by using a combination of policies, such as direct provision and legislation. This essay seeks to discuss the extent to which government should intervene in the market for street lighting.

Development

**Requirement 1: A government should intervene in the market via free direct provision to ensure that the benefits of street lighting can be obtained**

- Having well-lit streets can allow society to move around safely and minimize the possibility of crimes happening. Therefore, street lighting is integral to the well-being of society.
- Given the extensive benefits of street lighting to the society, free direct provision by the government is needed to obtain the benefits since no resources will be allocated to street lighting if left to the market. Free direct provision is a situation where the government directly controls the supply of the good/service and makes it available free of charge. In the case of street lighting, government supplies them at the socially optimal level at zero market price. The government may either produce these themselves or contract the production to the private sector. The government then finances the production of street lighting using tax revenue.
- Advantage: Government has control over the quality and quantity of street lighting provided. Direct provision means the government can ensure the "right" amount of right good is produced. In this case the government can plan accordingly (urban planning) for the areas which requires more street lighting and areas which may not need as many, thus minimising disruption caused to wildlife. In addition, having control over the quality of street lighting would mean that government can opt for "greener" options to obtain the street lighting – example energy-saving or more environmentally friendly lights to reduce the consumption of electricity and the negative externalities.

- **EV of Requirement 1:** [Criterion] Extent of market failure [Opinion] Free direct provision is likely to be very necessary for benefits of street lighting to be obtained though the extent of provision differs with the perceived extent of benefits. [Reasoning] Having well-lit streets can allow society to move around safely and minimize the possibility of crimes happening. Therefore, street lighting is integral to the well-being of society but will not be provided at all without government intervention. Hence, the extent to which the government will provide street lighting will be more in areas that are highly-populated.

**Requirement 2: A government should intervene in the market via subsidising "green" technology to ensure that the negative impacts can be minimized**

- To mitigate the negative effects such as pollution from electricity generation, the government can subsidise the production of "green" energy to reduce the carbon emissions from electricity generated from fossil fuels. If the subsidies lower the unit costs of production, such that it is now cheaper to generate electricity through cleaner methods, firms may switch their production methods away from burning fossil fuels. As more energy is generated by cleaner methods of production, the MEC decreases. The MSC therefore decreases to MSC' which is nearer to MPC.

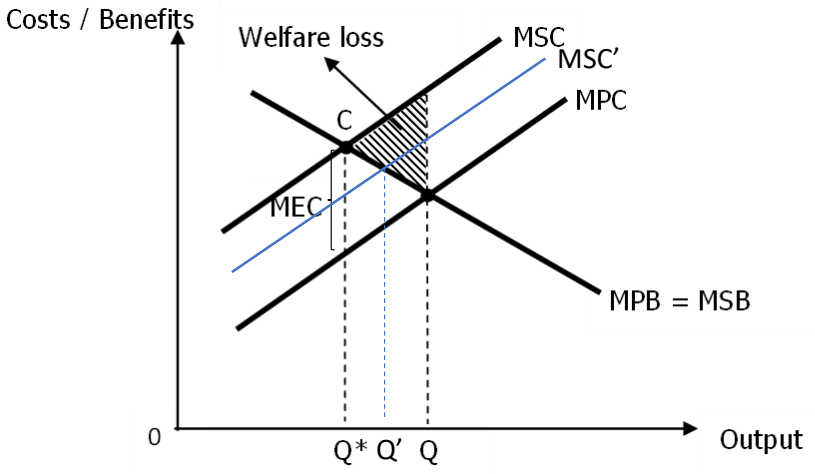


Figure 2: Decrease in MEC to correct the market failure associated with electricity generation

- The new socially optimal output will be higher at Q', where MSB = MSC'. The deadweight loss due to overproduction of electricity is smaller as compared to before. Hence, more electricity can be generated for street lighting while minimising the negative effects.
- Advantage: It addresses the root cause of the problem as once the cleaner methods are adopted, the emissions will be reduced and thus the negative externalities related to pollution will be permanently addressed.

- Disadvantage: Similar to free direct provision, subsidies are very costly. As governments have limited budget, subsidising the production of "green" energy could lead to opportunity costs in the form of welfare that could have been enjoyed by the society from the subsidies spent on healthcare. Hence if the welfare loss from the cut in healthcare subsidies outweigh the benefits of subsidies on production of "green" energy, it could lead to inefficient allocation of resources.

**EV of Requirement 2**: [Criterion] Budget Constraints [Opinion] Governments with greater availability of funds would be able to intervene to a greater extent. [Reasoning] As mentioned above, government expenditure on subsidies in electricity generation gives rise to opportunity costs and lesser funds for addressing other issues. Hence, for governments already facing a budget deficit, they would have to be prudent in their spending and prioritise their spending such that they only intervene heavily in markets that would bring about much societal welfare. Thus, they may have to forgo intervention in electricity generation etc.

***Alternative:***

- *To mitigate this problem, the government can implement legislation where appropriate to manage the problem. For example, government can enforce the use of cleaner renewable energy to generate electricity to power street lighting. This will ensure the generation of energy does not compromise with the cleanliness of air, which may negative externalities like respiratory problem to third parties. The need for compliance coupled with the threat of punitive measures forces producers to provide street lighting without air pollution. In addition, the government can also dictate the areas that require more street lighting vs those that do not so as to protect the wildlife.*
- *Advantage: Easy to understand and implement. Command-and-control methods are usually more straightforward to devise, easier to understand, and to implement. Legal restrictions backed by inspections which are sufficiently regular and rigorous and having punitive enough penalties can act effectively to achieve government aim.*
- *Disadvantage: Costly monitoring and enforcement. For this measure to be effective, the government may need regular checks to ensure adherence. High costs are incurred in sending government officials to check and monitor that laws are being followed.*

***EV of Requirement 2**: [Criterion] Whether legislation is going to be effective depends on the government's ability to finance the monitoring process. [Reasoning] If government has sufficient funds, monitoring can be carried out effectively to ensure the legislation is adhered to. In the case of Singapore government, due to their prudence in spending, the government does have the funds to effectively carry out monitoring and checks. [Opinion] So the government could intervene to a large extent given the higher probability of success in such a country as compared to countries where the governments have limited funds.*

**Evaluative Conclusion**

[**Criterion**] Availability of information/ Nature of economy [**Opinion**] Countries with greater availability and accuracy of information may be in a better position to intervene to a larger extent. [**Reasoning**] Intervention may see greater success in countries like Singapore due to the ease of obtaining updated information given its smaller size and advanced info-technology. This facilitates effective urban planning and estimation of the extent of market failure by the authorities which minimises the risks of over-provision and over-subsidising, and reduces the chances of government failure. On the other hand, bigger countries may be held back by the difficulties they face in estimating the optimal level of production and gathering sufficient up-to-date information on the different areas. Thus, their intervention may have to be more measured e.g. providing a conservative amount of street lighting, to avoid any wastage of resources and negative impacts on wildlife etc.

| Mark Scheme | | |
|---|---|---|
| **Level** | **Descriptors** | **Marks** |
| L3 | For a response which shows strong economic analysis and application in terms of how effective the government intervention is in obtaining the benefits of street lighting and minimising the negative impacts.<br>Recall the 2 requirements:<br>✓ Intervention to obtain the benefits of street lighting<br>✓ Intervention to minimise the negative effects<br>• 10mks: A + A (2 rigorously explained requirements)<br>• 9mks: A + C + K<br>• 8-9mks: A + C (1 rigorously explained requirement + 1 cursory explained requirement) | 8 – 10 |
| L2 | For an under-developed explanation of the 2 requirements. Appropriate economic concepts and analysis is used but application is lacking.<br>OR<br>For a well-developed explanation of only 1 of the requirements with some listing of others.<br><br>Recall the 2 requirements:<br>✓ Intervention to obtain the benefits of street lighting<br>✓ Intervention to minimise the negative effects<br>• 6-7mks: C + C<br>• 6mks: A + 0 (1 rigorously explained requirement) | 5 – 7 |
| L1 | For an undeveloped answer with a listing of points | 1 – 4 |
| E3 | For an answer that builds on appropriate analysis to evaluate the extent to which the government intervention is needed to obtain the benefits of street lighting while minimising negative effects. | 5 |
| E2 | For an answer that makes some attempt at evaluation of a conclusion that answers the question but does not explain the judgement or base it on analysis. | 3-4 |
| E1 | For an answer that gives superficial evaluative statement(s) without supporting analysis and elaboration. | 1-2 |