

Assignment 2

(ANSWER SHEET)

EE375 - Applied Economics for natural
resources and Environment
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Question 1

Suppose that the demand curve derived from marginal benefit associated with a consumption of chocolate is $360 - 4Q$ and the marginal cost of chocolate production is $6Q$. The marginal damage from pollutants generated by chocolate production is $2Q$

a) Find the social optimum or efficient production level (P^* , Q^*)

social optimum / efficient production level (P^* , Q^*)

given that demand curve derived from marginal benefit is $360 - 4Q$

marginal cost of chocolate production is $6Q$ ($MC = 6Q$)

marginal damage from pollutants is $2Q$

Recall formula

$$P = MC_S$$

$360 - 4Q = \text{marginal cost} + \text{marginal damage or externality cost}$

$$360 - 4Q = 6Q + 2Q$$

$$360 - 4Q = 8Q$$

$$360 = 12Q$$

$$Q^* = Q_S = \frac{360}{12} = 30 \text{ \#}$$

Next, substitute $Q^* = Q_S = 30$ in demand equation in order to find P^* or P_S

$$P = 360 - 4Q$$

$$P = 360 - 4(30)$$

$$P = 360 - 120$$

$$P^* = P_S = 240 \text{ \#}$$

In conclusion, the social optimum or efficient production level quantity is 30 and social optimum or efficient production level price is 240 #

b) Find the private equilibrium price and quantity when external costs could be ignored by firms

private equilibrium price and quantity

given that demand curve derived from marginal benefit is $360 - 4Q$

marginal cost of chocolate production is $6Q$ ($MC = 6Q$)

marginal damage from pollutants is $2Q$ → Ignored this !!!

Recall formula

$$P = MC_P$$

$$360 - 4Q = 6Q$$

$$360 = 10Q$$

$$Q_P = \frac{360}{10}$$

$$Q_P = 36 \text{ \#}$$

Next, substitute $Q_P = 36$ in demand equation in order to find P_P (private price)

$$P = 360 - 4Q$$

$$P_P = 360 - 4Q_P$$

$$P_P = 360 - 4(36)$$

$$P_P = 360 - 144$$

$$P_P = 216 \text{ \#}$$

In conclusion, the private equilibrium price is 216 and private quantity of chocolate production is 36 units #

c) What tax level should be set to achieve the efficient/social optimal

Tax level

Recall $D(WTP) \sim MB_p$ is $360 - 4Q$

Formula to Find tax level

$$MB_p = MC_s + t$$

$$360 - 4Q = 6Q + t$$

main key !! achieve the efficient or social optimal
Therefore, use a social optimal from question A which equal to 30

$$360 - 4Q^* = 6Q^* + t$$

$$360 - 4Q_s = 6Q_s + t$$

$$360 - 4(30) = 6(30) + t$$

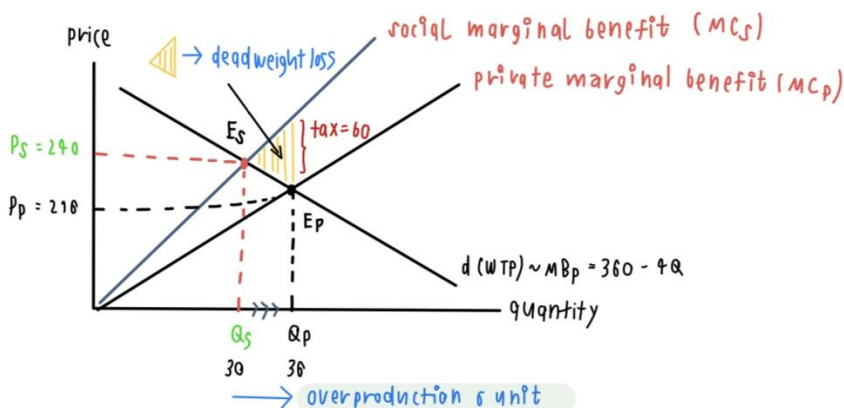
$$t = 360 - 120 - 180$$

$$t = 360 - 300$$

$$t = 60$$

∴ government should set up tax level is 60 ($t=60$)
in order to achieve the efficient or social optimal

d) Calculate deadweight loss from externalities in this case



assume deadweight loss is yellow area

Formula: $\frac{1}{2} \times \text{overproduction} \times \text{tax level}$

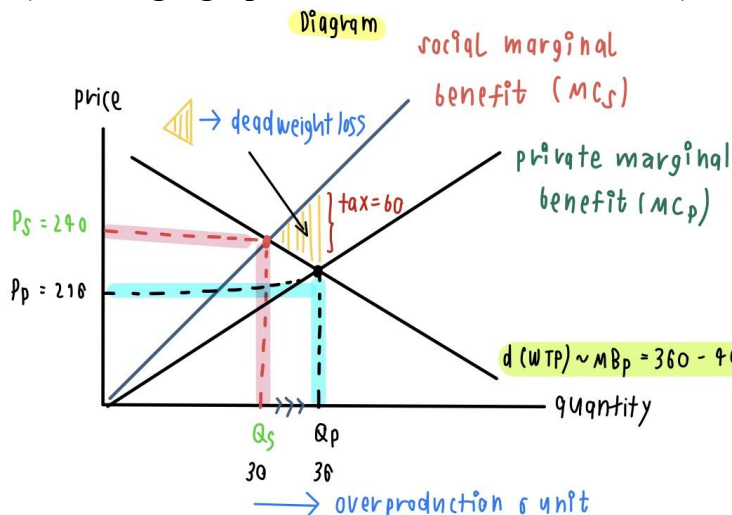
$$= \frac{1}{2} \times (36 - 30) \times 60$$

$$= \frac{1}{2} \times 6 \times 60$$

$$= 180 \text{ #}$$

In conclusion, the deadweight loss in this case is 180 #

e) Drawing a graph to illustrate the result from a) to d)



according to the diagram, It is the result from question A to question D.

summary the results

- $d(WTP) \sim MB_p = 360 - 4Q$
- Externality cost = 2Q
- MC of chocolate production = 6Q
- private price = 210
- private quantity = 36 units
- social optimal price = 30
- social optimal quantity = 36 units
- overproduction 6 units
- deadweight loss 180 units
- Tax level to achieve social optimal is 60

∴ All of these it can be contribute the negative externality !!

Question 2

The production of cigarettes increases water pollutions while the consumption of cigarettes can put their neighbours at health risks (Hint: Impact on social marginal benefits as a whole)

a) Explain how externalities in this case create inefficiencies in the cigarette market

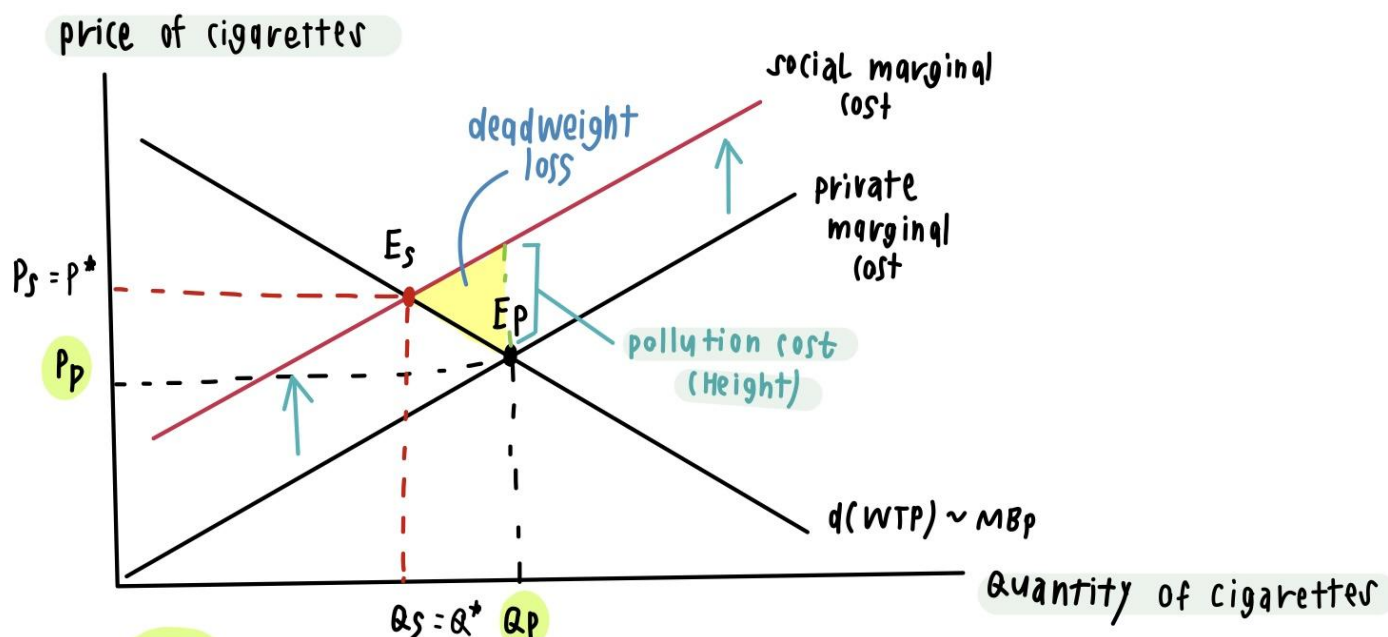
Answer As production and consumption of cigarettes impact social health, there is an external cost added resulted in the shift of supply curve from MC_p to MC_s with the lower quantity produced at a higher price or at (social optimal Q^* and P^*). If the company chooses to produce at a private optimal level where externality is **not internalised** (Q_m, P_m), there will be an overproduction and contribute to the deadweight loss area which means inefficient or create the negative externality and deadweight loss presented by the area in yellow.

draw a graph to illustrate your explanation, including the market equilibrium for cigarettes at

- socially optimal level, P^* and Q^*
- private optimal level (P_p and Q_p) when externalities are not internalised by both firms and consumers
- the deadweight loss area.

Diagram 1

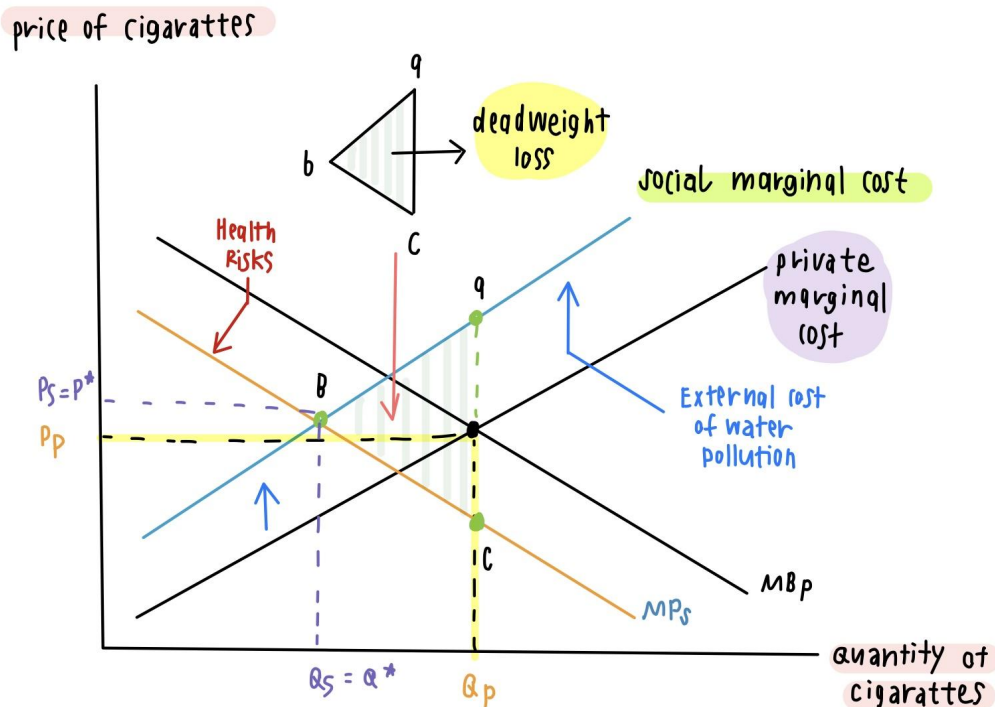
According to the situation, it certainly that production of cigarette increase can be create the increase the pollution cost shift up to red line which is social marginal cost.



note: Generally, a negative externality like pollution creates a **marginal cost** that is higher than the marginal private cost.

Diagram 2: Focus on the health risk (MBp shift downward to MP_s)

From another perspective, at the private optimum of price and quality, inefficiency arises when firms and consumers do not take into account the effects of externalities that stimulate water pollution and contribute health risk. If you look at the diagram, the cause of water pollution increases social marginal cost to social marginal cost (MCs) and **health risks reduce marginal benefit of consumers to MB_s**. Therefore, the social optimal level should be at point B (P* and Q*). Lastly, the inefficiency produces because the private quantity of production is more than the socially optimal production which leads to having the deadweight loss area in area ABC.



b) What policies could be considered to reduce deadweight loss in this case and describe the effects of such policies in the cigarette market.

1. In the case that the effect is small.

1.1 Property rules: If the consumer has the right to the water condition, and the firm wants to produce the cigarette and pollute the water, it has to pay the negotiation cost equal to the amount of externality it caused. At this point, the MC_p will shift to the MC_s as the firm has to lower its production cost, and the quantity produced will be at Q^* . Conversely, if the firm has the right of the neighbourhood, and the consumers want to smoke in that area, they have to pay the negotiation cost to the firm as well.

1.2 Liability rules: In this setting, if the firm's action harms other parties through the water pollution, it has to provide the compensation cost to the affected for all damages. On the other hand, if the consumers worsen their neighbours health condition, they have to pay the compensation cost as well. This rule will make the actors bear the consequence of their practices and reconsider their actions to minimise their opportunity cost.

2. In the case that the effect is large.

2.1 Restrict the production of cigarette: This approach limit the amount cigarette produced to Q^* . Since supply is less than demand, the price will go up and discourage the consumers to buy the product. In the end, the amount of cigarette traded will be at Q^* which is the social optimum amount.

2.2 Impose a per-unit tax on cigarettes: If the authority puts a per-unit tax on cigarettes at the same cost as an external cost of cigarettes, the MC_p curve will shift to MC_s curve since the firm has to lower its production function to cut the cost. So, the amount cigarette produced and consumed will equal to Q^* which is the social optimum amount.

2.3 Establishing rules to permit some activities: There are 3 aspects to this method which are the firm and the consumer, and the both one. For the firms, there may be rules that permit draining the wastewater in some areas. For the consumers, there may be a restriction about the use of the cigarette such as individuals cannot smoke in public space, or a law that limits the amount of cigarettes that individuals can purchase per day to control the pollution. For the third one, the government may apply both consumer and producer policies not to put pressure only on a particular party.

In conclusion, Imposing tax on cigarettes can be used to reduce deadweight loss as it will make the company lower production prices due to higher cost. Moreover, there might be a decrease in consumption because higher prices might lower demand.