Exam SØK1101 May 2024, 4 hours

Answer all 3 questions. All questions worth equal weights.

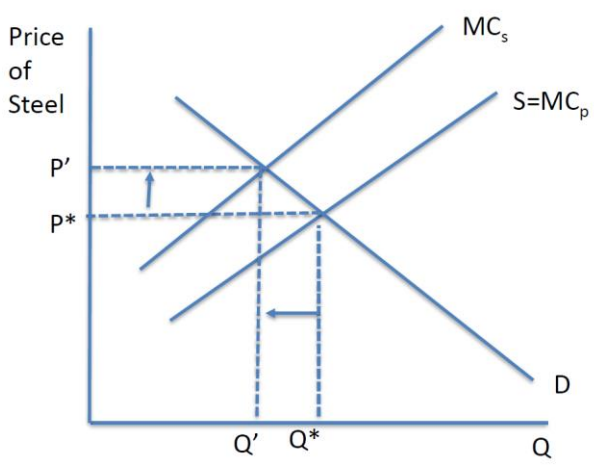
Question 1 Externalities

a. Demonstrate how negative externalities, such as pollution, leads to reductions in economic surplus.

The key elements to answering this question are:

First demonstrate the difference between the market outcome based on private marginal cost and social marginal cost. A good answer would explain clearly why these two cost curves differ. The private marginal cost includes only costs incurred by the firm in production. The difference between the private and social marginal cost curves reflect the additional costs their production (i.e. pollution) imposes upon society. In the absence of regulation / property rights, the producer does not incur these costs and hence they do not consider them when making their production decision. Instead they produce until their cost equal the marginal revenue they receive from production (given by the demand curve which is equivalent to the marginal willingness of consumers to pay)

Second. The answer should demonstrate the consequence of this. A sufficient approach is to show that this means that too much is produced at too low a price, with too much pollution. For example:



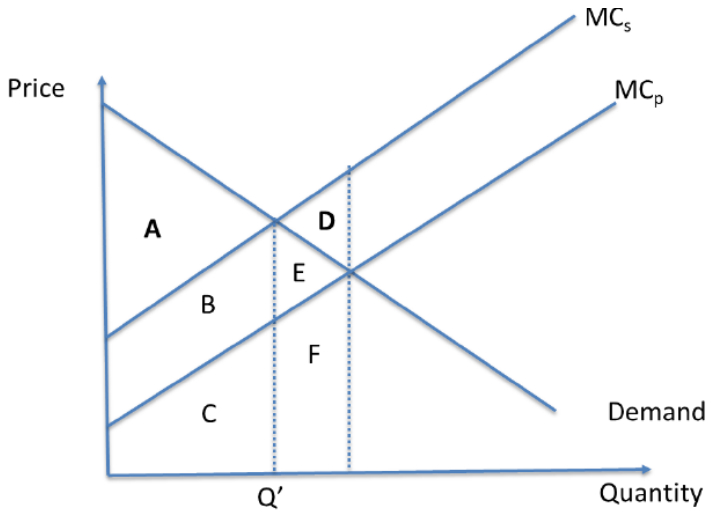
What does this mean?

The privately and socially efficient levels of steel production **diverge**

This is because the additional costs to society are not incorporated in the steel firm's decisions

P', Q' give the **socially efficient levels**

A better answer would more clearly demonstrate how this leads to lower social welfare, for example:



Now we want to think about **Social Surplus (Total Social Benefits – Total Social Costs)** and reintroduce the externality

$(A+B+C+E+F) - (B+C+D+E+F) = \mathbf{A\text{-}D}^{Q_p}$

b. Illustrate and discuss how assigning property rights can, in principle, solve problems related to negative production externalities.

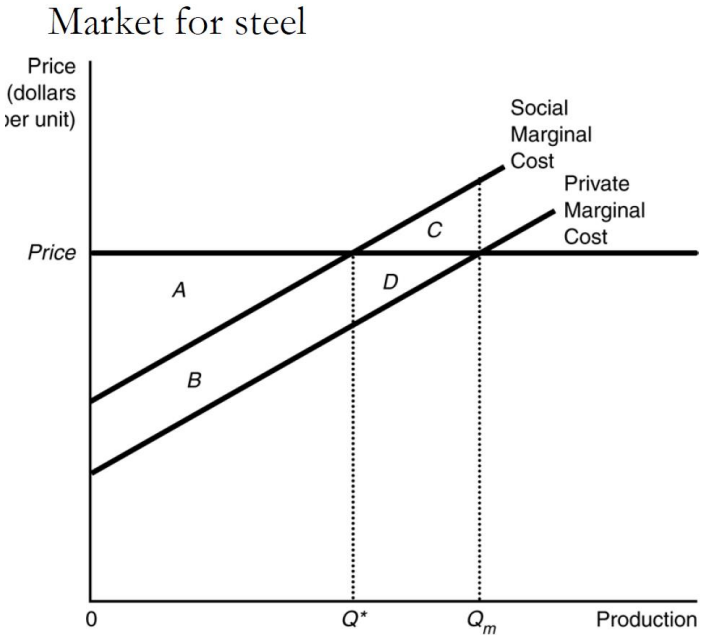
This is a question regarding the Coase Theorem. As a result, the expectation is to explain that the problem in 1a comes from a lack of property rights over the place (i.e. river) where the pollution is being placed.

The answer should then explain clearly how assigning property rights to either party (right to pollute, right to clean water / air) and then allowing negotiation can, in principle, solve the externality problem.

The standard approach would be to use the diagramme below to explain how both parties can be made better off through negotiation (or at least one party better off and the other indifferent). For example using the right to pollute starting point then fisheries will be willing to pay C+D to the steel firm to reduce pollution to Q from Qm. Then the fishery is indifferent (they have paid exactly enough) to cover the differences in pollution costs, while the steel firm is better off by C.*

A very good answer would be able to explain this point from both the right to pollute and the right to clean water starting points.

Additional points could be made about (a) that efficiency is not a function of how gets the rights but (b) surplus is as it is the granting of valuable property rights to party and (c) the limitations to this working (i.e. problems with negotiation).



Question 2 Depletable Resources

There is a depletable resource stock of 30 to be allocated across two periods

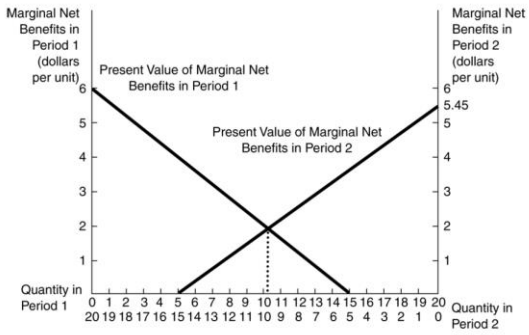
A demand curve is P=25-0.5Q that is identical across periods

The marginal cost of extraction is 5

Use a discount rate of 0.08

a. Illustrate the optimal allocation of Q across the two periods.

Should draw a standard 2 period optimal allocation diagramme similar to that below:



This should have the following key features

1. *The y-axes are MNB1 and MNB2 (not prices!)*
2. *The two MNB curves should cross to the right of centre. With discounting more is always consumed in the second period.*
3. *The MNB2 curve cuts the right hand side y-axis below 20 due to discounting (at 18.51)*
4. *X-axis labelled 0 to 30 left to right highest line and 0 to 30 lower line*

5. *Q1 is 40 when MNB1 is 0. This means that the MNB1 curve cuts the right hand side y-axis before it reaches the x-axis (the opposite for MNB2)*

b. Solve for quantities, prices, and marginal user costs in both periods.

(Note I give 2 digit decimal places below – but I gave full marks for approximations)

MNB1 = 20-0.5Q

MNB2 = 18.51 – 0.462Q

Q1=30-Q2 and Q2 = 30-Q1

And MNB1 = MNB2 in equilibrium

Then (for example)

20-0.5Q1 = 18.51 -0.462Q2

And substituting using the resource constraint

20-0.5Q1 = 18.51 -0.462 (30-Q1)

Solve for Q1 = 15.95

Therefore Q2 = 14.05

Substitute both values into the original demand functions to find price (note do not discount when finding P2!)

Hence P1 = 17.025

P2 = 17.975

MUC1 = P1-MC = 12.025 and MUC2=P2-MC =12.975

c. Imagine that we knew with certainty that there will be a cheaper, renewable, substitute available in the 2nd period. Discuss what this would do to usage in period 1 (Q1) and why.

Here I was looking for an understanding of how the restriction in usage in the first period reflects the opportunity cost of lost consumption / production in the second period. Renewables in the 2nd period lower the value of the non-renewable resource in the 2nd period. This reduces the opportunity cost of using it in the first period, leading to higher levels of extraction and use in this period.

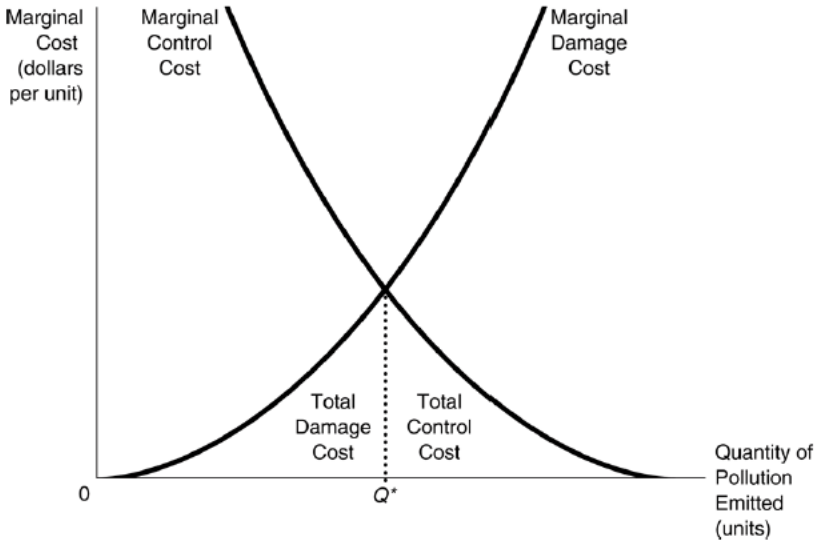
Question 3 (25%) Pollution and Policy

a. Demonstrate the optimal level of pollution. Why is this level not usually zero?

The key point is to demonstrate and discussing how:

(a) marginal damage costs are increasing in pollution (i.e. the marginal damage cost curve is increasing in pollution)
(b) while the cost of reducing pollution go up as we reduce pollution (marginal control / abatement cost curve)
(c) The optimal level of pollution, as shown before is where these two curves meet

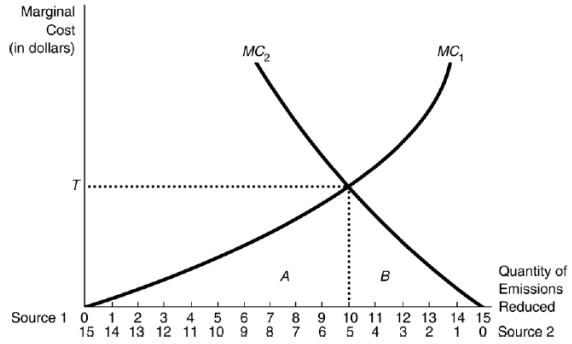
A very good answer would explain how other levels of pollution than Q are not the minimum cost level.*



Why is this not usually zero – above that would mean that the costs of controlling pollution would far outweigh the costs of pollution. A good answer could show the case using the standard 'K-shape' diagram where the optimal level of pollution is zero.

b. Demonstrate the most cost-effective way to reduce pollution across 2 firms with different marginal costs of pollution abatement.

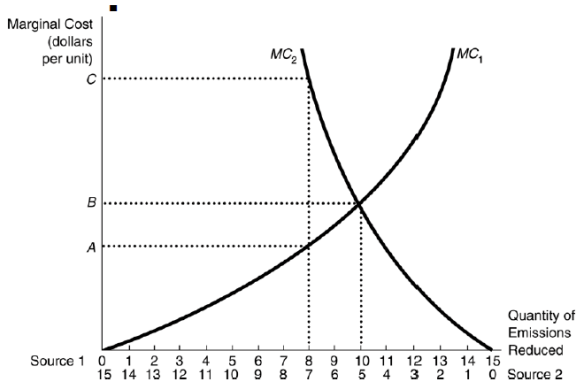
The most straightforward way to answer this is diagrammatically showing how the cost minimizing distribution is where the marginal control costs of the two firms equate. A good answer could mention that this involves the firm with the lower marginal costs of control reducing pollution more



c. Compare and discuss taxation and cap and trade (permits) based methods to achieve this reduction.

First a good answer would use the diagramme above to demonstrate how the tax level T leads to the optimal (cost-minimising) distribution of pollution reduction.

Second, a variant of the figure below could be used to demonstrate how cap & trade leads to the optimal mix irrespective of the original distribution. For example, by taking an initial distribution and explaining why the two firms will be willing to trade permits until they reach the equilibrium distribution.



Finally, an excellent answer could discuss (a) the different information requirements of the two schemes (b) how they differ in their response to changes in pollution technology and / or business cycles.