SØK 1101 Environmental and Resource Economics

Term Paper 2022, Due 8th April 12 Noon

The exercise can be done individually or in groups of up to 4 persons.

All questions should be answered.

The term paper must be submitted as a single pdf file via Blackboard (handwritten answers can be scanned to pdf).

See guidelines for submission on Blackboard.

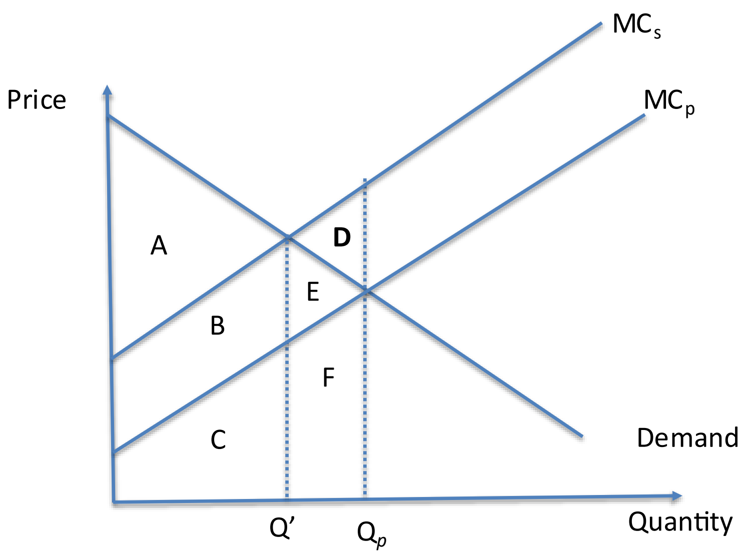
Question 1 Markets and Externalities

a. Consider a two-firm model (e.g. fishery and steel firm) with negative production externalities (i.e pollution). Demonstrate how externalities leads to reduced social welfare.

(a) A diagramme showing a demand curve and a marginal private cost and a marginal social cost curve (where the MSC curve is higher) – ideally should explain what the source of the difference is (i.e. pollution)

*(b) Demonstrate how this leads to a lower price and higher quantity of production than at the social optimal (i.e. P*private < P*Social)*

(c) And really ideally show (using areas under the supply and demand curves etc) how total surplus (welfare) is lower. See below slide:



Trondheim – Gjøvik – Ålesund

D is the **deadweight loss** associated with overproduction – it is the net loss of overall surplus due to (socially) inefficient production

What happens if we go to socially optimal production (Q') then net social benefits are **A**. By definition **A>(A-D)** and here you can see the sense in which D is a net loss relative to social optimal

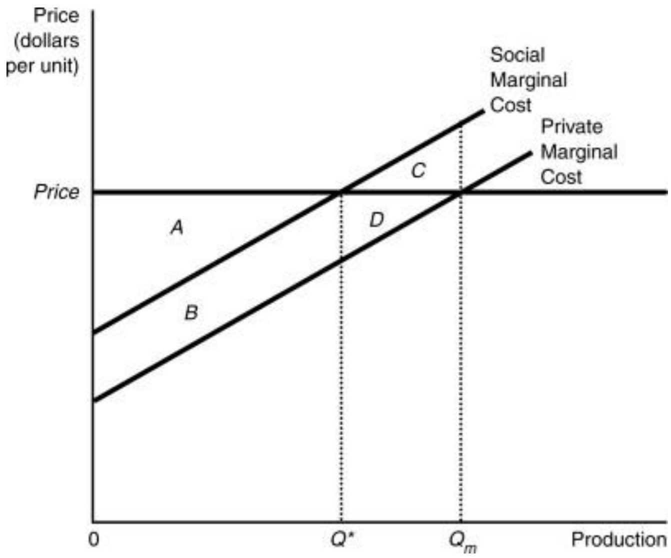
b. Show how negotiation can achieve the socially optimal (i.e. static efficient) level of production and pollution. Show this for the case of (i) a right to pollute and (ii) right to clean water.

Show the Coase Theorem outcome from two perspectives. Could first discuss how the problem arises from a lack of property rights over the water.

(1) Right to pollute

Efficient Output w/negotiation (fig 2.10)

Market for steel



Assume steel firm has rights over river (rights to pollute)

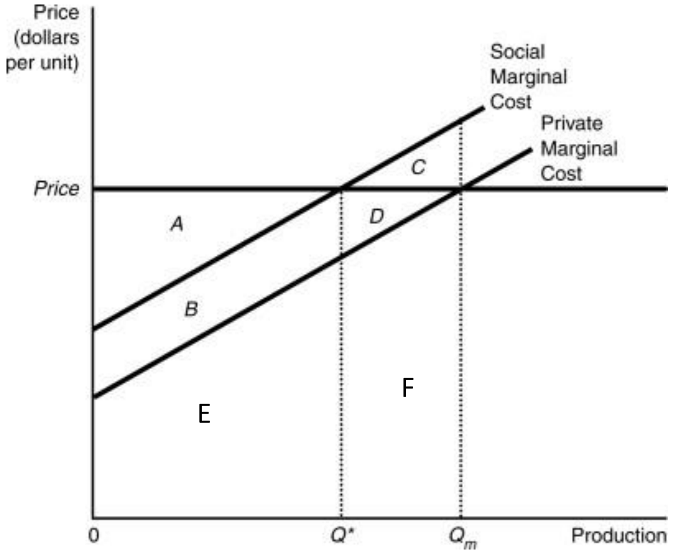
Fix price at P=price just to make diagramme clearer (flat demand curve)

Fishery offers **C+D** compensation to steel firm to reduce pollution (reduce production Q_m to Q*)

Right to clean water

Efficient Output w/negotiation (fig 2.10)

Market for steel



B is the cost to fishery (pollution damages) of Q* steel production

E is cost of production to Q* to steel firm

A+B is the producer surplus

So steel firm would be willing to pay **At least B**

But A+B would make them indifferent between 0 and Q* production

9 NTNU

Question 2 Intertemporal Allocations

Consider a 2-period model with a finite non-renewable resource. There are 18 units available. The demand function for both periods is P=10-0.25Q. The marginal cost of extraction is \$2. Use a discount rate of 6% and demonstrate (diagrammatically and numerically) the optimal allocation across both periods (quantities).

Calculate prices in and marginal user costs in both periods.

First things first - I set up a slightly strange example. As many pointed out there would be shortages of supply even in a one period model.

First display this in a 2 period 'box diagramme'. I.e. (a) the x-axis goes from 0 to 18 left to right, and 0 to 18 (on the line below) right to left. (I have endeavoured to draw this below)

Then create MNB i.e. 10-0.25Q-MC = 8-0.25Q (MNB1). And the discounted version of this for (by 6%) for period 2 (MNB2).

Plot both of these, show intersection, key point is that they intersect such that slightly more than 9 is allocated to period 1 and (naturally) less than 9 to period 2.

Then solve for quantities and prices.

For example we know that MNB1=MNB2 at equilibrium and that Q1 + Q2 =18

Hence

8-0.25Q1 = 7.55 – 0.235Q2 (approx.)

Set Q1=18-Q2

Substitute

8-0.25(18-Q2)=7.55-0.235Q2

8-4.5+0.25Q2=7.55-0.235Q2

3.5 + 0.25Q2 = 7.55-0.235Q2

4.05 = 0.485Q2

Q2=8.35

Q1 = 9.65

Substitute quantities into original demand functions (not the the MNB functions – common error) to generate prices.