Study Questions to Accompany International Energy Markets

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Chapter 11. Externalities and Energy Pollution

11.1. Suppose that ethanol production in Brazil is creating environmental problems and other externalities. The Brazilian government has estimated the cost of the externality is $0.5/lt of ethanol and the demand and supply of ethanol to be Qd=5,400 -1,8 and Q_s = 7,200P – 4,500.

11.1a. What will be the market equilibrium price and quantity?

11.1b. What are the price and quantity, once the externality is internalized?

11.1c. On a diagram show the supply and demand and the social losses in the private market.

11.1d. Calculate the social losses

11.2. Suppose that instead of energy production causing pollution, energy consumption causes the pollution. Let the supply of gasoline equal Q_s = -10 + 16P and the demand (a measure of private benefits) equal Q_d = 12 - 4P. The external costs are 0.25 per gallon.

11.2a. What would the market price and quantity be?

11.2b. What are the optimal price and quantity?

11.2c. What would a tax have to be to make the private and the social cost the same?

11.3 Suppose the total cost of a pollutant (X) in Stockholm is TC =$-10X+0.065X^2$ for X>8 and the total benefit of pollution in Stockholm is TB = $35X - 0.625X.^2$ The MC and MB are represented in the following diagram
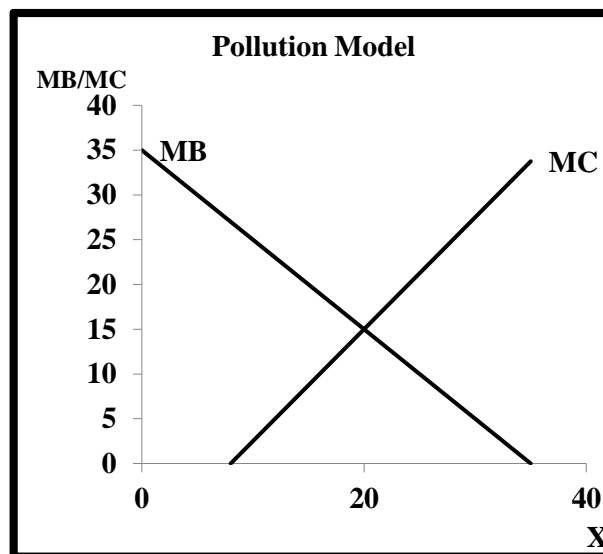
11.3a Compute the optimal level of this pollutant in Stockholm and represent it graphically.

11.3b If the polluter had the property right what do you expect pollution would be? Compute the social losses for this case and represent them graphically?

11.3c If the group suffering the damages or costs had the property right what do expect pollution would be? Compute the social losses for this case and represent them graphically?

11.3d. If there are no transaction costs, Hotelling argues that the market could get us to the optimal level of pollution. Suppose there are two players the polluter (Ms. Dirty) and the one who suffers the damages (Mr. Clean) Discuss how this might occur if Dirty has the property rights?

11.3e Discuss how the market might get to an optimal level of pollution if Clean has the property rights.

11.3f What would be the optimal level of pollution if technology changed so that the pollution removed could be recycled and sold commercially. Suppose this lowers the total benefit of polluting to TB=$10X-X^2$.

11.4 Four potential policies to get to the optimum level of pollution include two that influence the price (a tax (τ_t) and a subsidy (τ_s)) and two that influence the quantity (command and control (Xc) and tradeable permits (Xp)). Again assume the costs and benefits for Stockholm. TC =-$10X+X^2$ for X>8 and the total benefit of pollution in Stockholm is TB = $35X - 0.625X^2$ Let's analyze the efficiency and distribution effects of each of these policies.

11.4a. What should an optimal unit tax (τ_t) be set at in the market? Compute how much revenues the government would collect at the optimal tax? What is the net benefit of pollution for the polluter and the net cost for the one who suffers the damage. Represent these distribution effects graphically.

11.4b. What should an optimal subsidy (τ_s) be set at in the market? Compute how much the subsidy would cost the government? What is the net benefit of pollution for the polluter and the net cost for the one who suffers the damage. Represent these distribution effects graphically.

11.4c What should an economically optimal command and control law (X$_c$) be set at in this market? What is the net benefit of pollution for the polluter and the net cost for the one who suffers the damage. Represent these distribution effects graphically.

11.4d If a cap and trade policy were set, how many permits should be issued (X$_p$). What should their price be? If the government sells the permits, how much revenue does it get. What is the net benefit of pollution for the polluter and the net cost for the one who suffers the damages? Represent these distribution effects graphically.

11.4e. Although all policies, if properly enforced, could get us to the optimal level of pollution, they have different distribution effects. If the firm originally had the property rights, graphically show their net losses for all four policies. Compare the costs to the firm of all four policies - a standard, a tax, a marketable permit, and a subsidy. Which would the firm prefer?

11.4f. If the pollutee (the one who suffers the damages from pollution) originally had the property rights, graphically show their gain for all four policies.

11.5 Let the marginal cost of pollution in Manhattan be 0 for Q < 5 and MC$_m$=-10 + 2Q for Q > 5. Let marginal cost of pollution in Wyoming be 0 for Q < 10 and MC$_w$=-10 + Q for > 10. Suppose the marginal benefits of pollution are the same in both places MB = 20 - 0.5Q.

11.5a. What is the optimal level of pollution in Wyoming? in Manhattan?

11.5b. What are the social losses if the environmental protection agency, U.S. EPA, sets the standard at 15 in both places?

11.5c. If the U.S. EPA could only set one standard, would they be better off setting the standard at the optimal Wyoming rate or the optimal Manhattan rate?
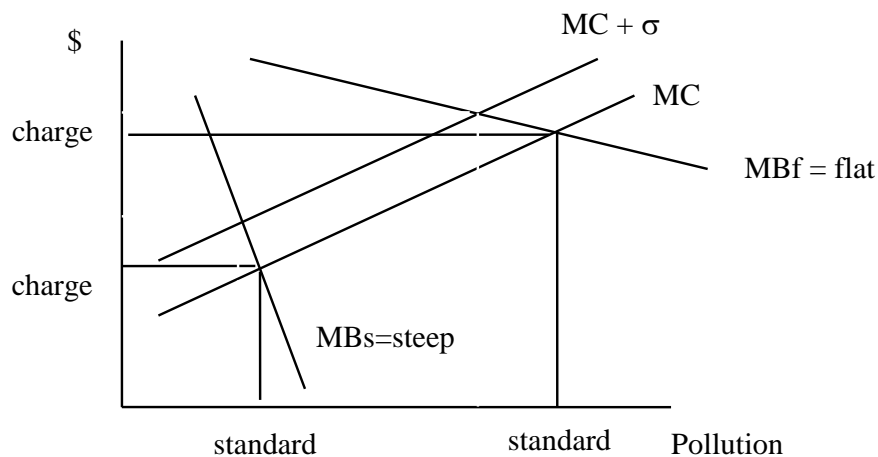
11.6 Often the costs and benefits of pollution are uncertain. Let's investigate the effects of policies in various cases when the regulator was wrong about costs or benefits.

11.6a If the marginal cost curve is steep (MCs) as on the right of the diagram below, show whether a charge or a standard would have a greater loss, if marginal benefits were different than expected (MB+σ instead of MB).
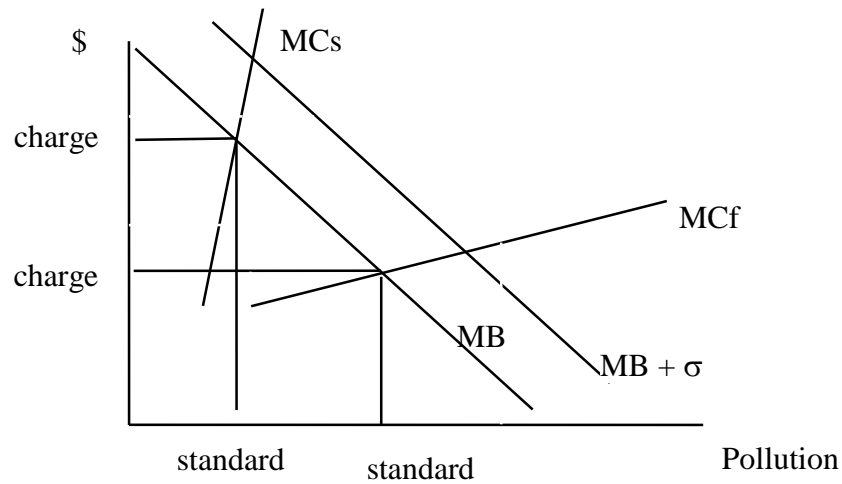
11.6b If the marginal cost curve is flat (MCf) as on the right of the diagram above, show whether a charge or a standard would have a greater loss, if marginal benefits were different than expected (MB+σ instead of MB)?

11.6c If the marginal benefit curve is steep as on the right of the diagram below, show whether a charge or a standard would have a greater loss, if marginal costs were different than expected (MC+σ instead of MC).

11.6d If the marginal benefit curve is flat as on the right of the diagram above, show whether a charge or a standard would have a greater loss, if marginal costs were different than expected ($MC+\sigma$ instead of MC).

11.7 Let two firms have MB from pollution of $MB_1=20-X_1$ and $MB_2 = 10 -(1/4)X_2$. If there are no fixed costs for abatement, the corresponding marginal cost curves for abatement are $MC_1=A_1$ and $A_2=-(1/4)A_2$

    11.7a. What will be the level of pollution in an unregulated case?

    11.7b. Suppose EPA decides they want to reduce total pollution to $X =30$, and they limit each firm to 16 units of pollution emitted by each firm. What is the cost of abatement in this case?

    11.7c. The EPA caves in to political pressure and issues 32 tradable pollution permits. What is the level of pollution in this case? How much does firm 1 abate? How much does firm 2 abate? What is the total cost of abatement?

11.8 What is the value of life if the probability of dying in a dangerous industry is 0.2% and the extra salary earned is 1000?

11.9. Goodstein (1995) suggests that evaluating hazardous waste legislation is difficult. What evidence can you find to decide whether you think such legislation has been successful or not? You may limit yourself to one country or do comparisons across countries.

11.10. Why have developing countries been reluctant to join a global greenhouse gas emission reduction agreement? Suggest a policy that might induce them to join the agreement.

11.11. You are the manager of the Emergency Response Department of a large shipping company. It's January, and you are loafing around on the last day of your New Year holiday, when the phone rings. Your worst nightmare has come true - one of your company's oil tankers has run aground off the Shetland Islands and is spilling crude oil. You have to clean it up. The crew has already been airlifted off the ship, but since then the weather has gotten much worse. Gale force winds are blowing and whipping up large waves. Develop a response strategy plan. Things you should include are

    11.11a. What kinds of damage is the spill likely to cause?

    11.11B. What technologies are available to clean up the spill?

    11.11c. How are you going to handle the press?

    11.11d. What information would you collect to try and prevent this from happening again?

11.12 For the situation in question **11.11** divide the class into three stakeholder teams (company, government regulator, and environmental group). Hold a press conference in which each of the stakeholder teams present their point of view to optimize their interests from the accident. (This would likely be to minimize damages or move their own agendas along.)

11.13. Browse the site (https://www.ceres.org/). Note the companies who are participating. After taking a look at the form, if you were CEO of a large energy corporation would you be inclined

to endorse these principles and prepare an annual self-evaluation? Why or why not? Your grade does not depend on whether you endorse these principles but upon your justification.

11.14 The link http://www.gksoft.com/govt/en/ has links to governments around the world. See if you can find a governmental organization with good environmental information. Write a brief description in English of the information in the link. Indicate the language or languages of the link.

11.15. If anthropogenic pollution had no benefits, there would be none. If it had no costs we wouldn't care. Discuss the components of these costs and benefits that make pollution an important economic problem.