Economics 3250 Dr. Lozada
Spring 2008 Exam 2

Do Not Turn This Page Over Until You Are So Instructed!

This exam has 25 points. There are six questions on the exam. The questions are worth different numbers of points, as indicated on the exam.

Put your answers to the exam in a blue book or on blank sheets of paper.

You have **one hour** (that is, until **2:25pm**) to take this test. After the test is over, I'll lecture until the regular class period ends.

Answer the questions using as much precision and detail as the time allows. Correct answers which are unsupported by explanations will not be awarded points.

Answer all of the following six questions.

1. **[6 points]** Using a graph which has "Pollution Abatement" on its horizontal axis, show that a Pigouvian tax can be more efficient than a Standard for limiting pollution.

2. **[4 points]** Your textbook mentions "technology-based standards," "ambient-based standards," and "benefits-based standards." Define these terms and discuss which of these standards tend to be more efficient.

3. **[4 points]** Draw a graph with "effort" on the horizontal axis and "dollars" on the vertical axis. On this graph, draw the steady-state total cost curve and steady-state total revenue curve for a fishery. Then identify on the graph:

   (a) the level of effort which maximizes profit if the fishery is private property;

   (b) the level of effort that results from an open access fishery; and

   (c) the maximum sustainable yield level of effort.

   Please remember to explain all your answers: tell me *why* your answers are correct.

4. **[4 points]** Draw a graph with "quantity being mined of an exhaustible resource" on the horizontal axis and "profit" on the vertical axis. Suppose this relationship looks somewhat like an upside-down letter "U." On this graph, illustrate the Hotelling Rule. Also, talk about where on this graph a firm which is *not* an exhaustible-resource firm is located. What is the difference between the way a non-exhaustible-resource firm behaves and the way an exhaustible-resource firm behaves? (It is OK to confine your answer to just the neoclassical point of view.)

5. **[4 points]** Defend the following opinion. (It's not necessarily my opinion, and it might not be yours, but construct a defense for it anyway.)

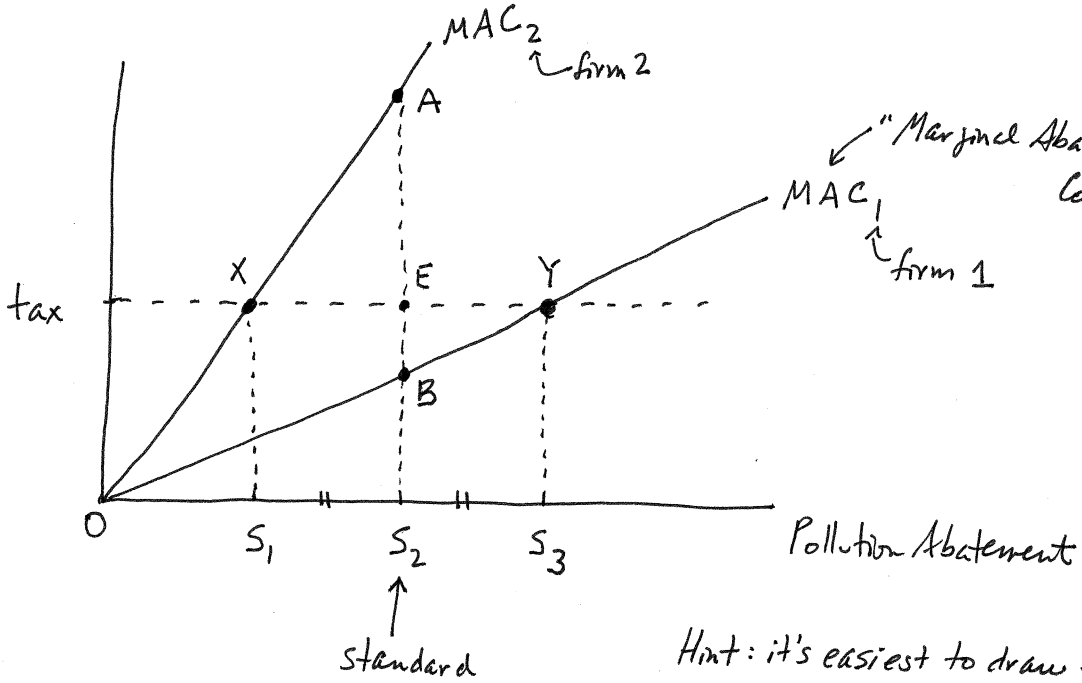
   > "Purely voluntary actions by polluting firms to reduce pollution do help a little, but they are not enough to reduce pollution by as much as it should be reduced."

Use a graph in your answer.

6. **[3 points]** Explain the following sentence: "Deposit-refund systems are a tool to manage municipal solid waste."

Answers to Econ. 3250, Exam 2, Spring 2008

(1)



Hint: it's easiest to draw S_1, S_2, and S_3 first, then draw the tax line, then draw the MAC's.

Under the standard, Firm 1 goes to B and Firm 2 goes to A. Reason: engaging in <u>less</u> Pollution Abatement than S_2 is illegal, and engaging in <u>more</u> Pollution Abatement than S_2 just decreases profit. Since total abatement costs are the area under Marginal Abatement Costs, Firm 1's costs are OBS_2 and Firm 2's are OAS_2.

Under the tax, Firm 1 goes to Y, with S_3 Pollution Abatement. Engaging in any <u>less</u> Pollution Abatement would save Pollution Abatement costs, along OY, but cost taxes, along XY, so would cost more than it saves. Engaging in any <u>more</u> Pollution Abatement would save taxes, along the horizontal line from Y, but cost more for Pollution Abatement along MAC_1 to the right of Y, so this would also cost more than it saves. So Y is Firm 1's location.

Similarly, under the tax, X is firm 2's location.

Total Abatement costs under the tax are $OYS_3 + OXS_1$. Under the standard they were $OBS_2 + OAS_2$.

Pollution is by construction the same under the standard $(S_2 + S_2)$ and the tax $(S_1 + S_3)$, since $S_2 + S_2 \stackrel{?}{=} S_1 + S_3$; subtract S_3 and S_2 from both sides:

$S_2 - S_3 \stackrel{?}{=} S_1 - S_2$ which is true by construction.

So since pollution is the same in this example, the most efficient option is the one with lowest total Pollution Abatement costs. The tax will be better than the standard, therefore, if $OYS_3 + OXS_1 < OBS_2 + OAS_2$.

This is equivalent to $OYS_3 - OBS_2 \stackrel{?}{<} OAS_2 - OXS_1$

$$BYS_3S_2 \stackrel{?}{<} XAS_2S_1$$

which is true since

$$BYS_3S_2 < EYS_3S_2 = XES_2S_1 < XAS_2S_1 .$$

since $\overline{S_1S_2} = \overline{S_2S_3}$

(2)

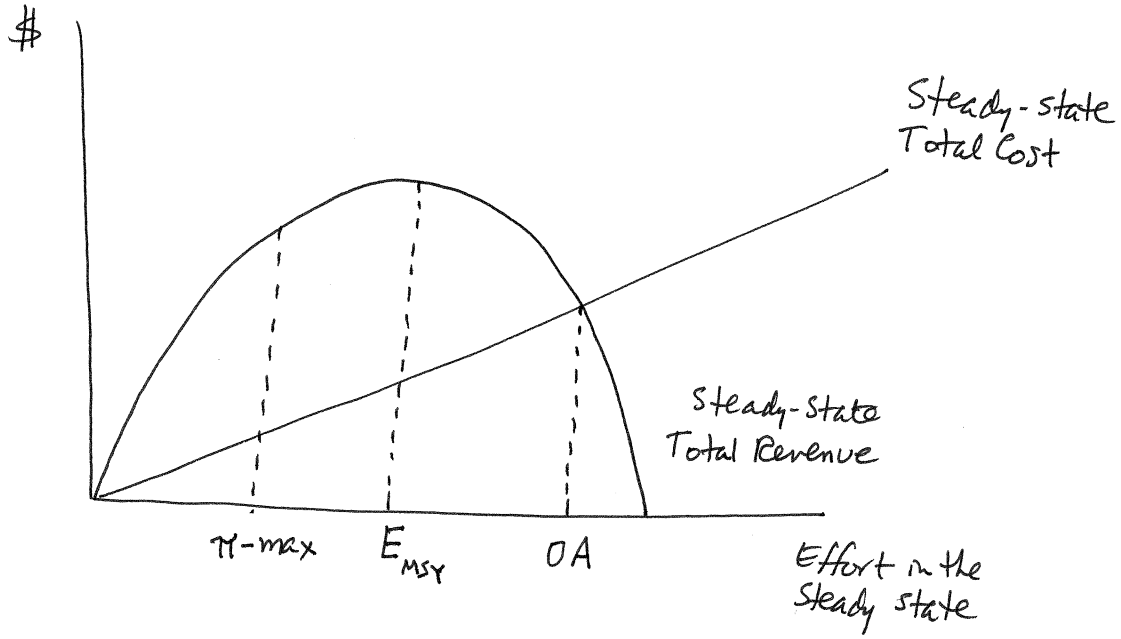
technology-based standards: mandate the use of certain kinds of machines and techniques to reduce pollution

ambient-based standards: require firms to ensure that ambient (i.e., prevailing) air or water quality is at least as good as a certain level

benefits-based standards: either technology-based standards or ambient-based standards where the standard is set using cost-benefit analysis.

Benefits-based standards are designed to be economically efficient, so they are usually the most efficient. Technology-based standards tend to be the least efficient, since they don't regulate what people care directly about, which is ambient air or water quality. Ambient-based standards' efficiency is in between the efficiency of the other two.

(3)

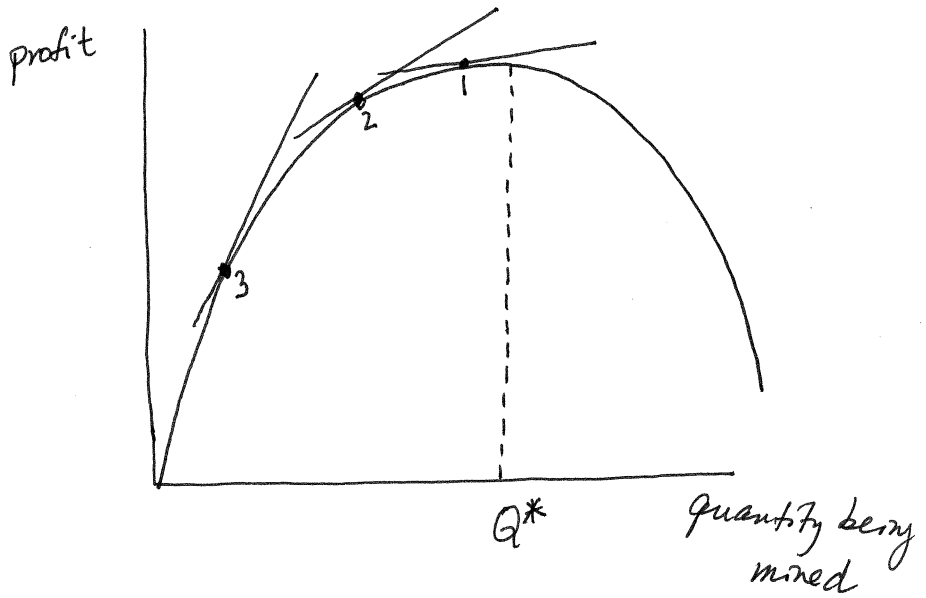


a) The private-property fishery goes to Effort at "π-max." This is where profit is maximized. The positive profit earned at π-max does not attract new firms to enter the fishery because they can't: it's private property.

b) Under open access, entry and exit of firms cannot be prevented. Any profit > 0 would attract entrants, and any profit < 0 would result in exit, so only zero profit, at Effort = "OA," would occur in the long run.

c) This is at E_{MSY}: this clearly maximizes Total Revenue, and so must maximize the size of the fish catch, which is the yield.

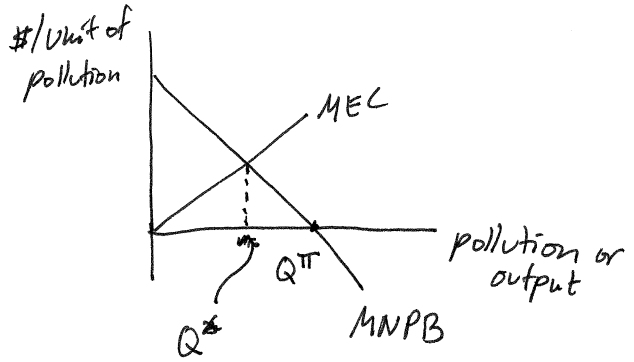
(4.)

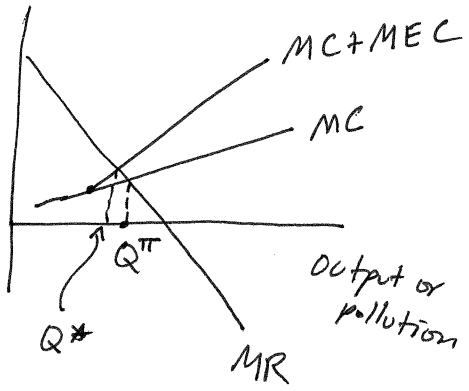


A non-exhaustible resource firm chooses Q^*, which maximizes short-run profit.

An exhaustible resource firm cannot choose Q^* forever. So instead, it maximizes the present discounted value of profit by following the Hotelling Rule, which makes marginal profit — indicated by the slopes of the lines in the figure — rise at the rate of interest. These slopes rise as you move from points like 1 to 2 to 3. Note that as marginal profit is rising, total profit is falling.

(5)





MNPB : marginal net private benefit

MEC : marginal external costs

MR : marginal revenue

MC : marginal cost

Either one of these graphs, and others might do as well, show that where the firm wants to go, Q^{π}, produces more pollution than the socially-optimal level, which is Q^*.

A firm's actions to control pollution might generate for it a "green" (i.e., environmentally friendly) image. This would decrease MNPB or MR, because the returns to polluting would be less. But the firm would not internalize <u>all</u> the external costs, so there would still be MEC (MEC would not be zero). Hence Q^* would still be less than Q^{π}.

(6)

Municipal solid waste ("MSW") disposal is often under-priced, leading to too much MSW. The "deposit" part of a deposit-refund system is like a tax on disposal, and the "refund" part is like a subsidy on not throwing the item away. Together, they give an incentive to reduce MSW generation, encouraging recycling instead.