Economics 3250 Dr. Lozada
Spring 2018 Exam 2

This exam has 25 points. There are six questions on the exam. Most of the questions are worth 4 points, but one is worth 5 points.

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

You have the entire class period (80 minutes) to take this test.

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.*

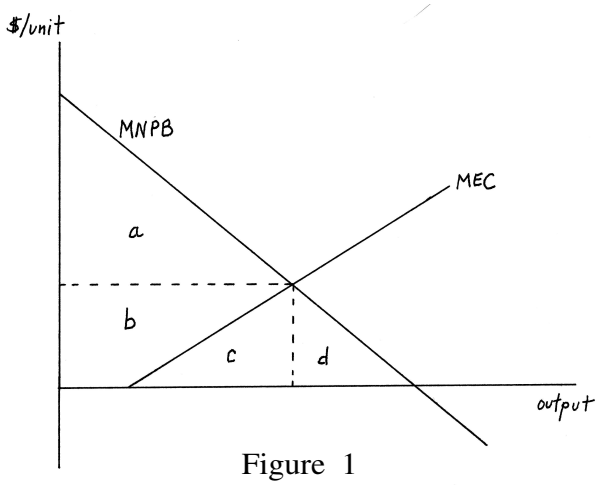

Figure 1

Answer all of the following six questions.

1. **[4 points]** In this question, ignore any possibility of Coasian bargaining.

   Refer to Figure 1.

   (a) Interpret regions *a*, *b*, *c*, and *d* (either separately or in whatever groupings you feel are appropriate) if there is no government regulation of pollution.

   (b) Interpret regions *a*, *b*, *c*, and *d* (either separately or in whatever groupings you feel are appropriate) if the government imposes an optimal pollution tax.

   (c) Interpret regions *a*, *b*, *c*, and *d* (either separately or in whatever groupings you feel are appropriate) if the government imposes an optimal level of output using "command and control."

2. **[4 points]**

   (a) Suggest how the government could design a "tradeable permit" ("cap and trade") pollution control system to avoid "hot spots."

   (b) If the government implemented your suggestion in part (a) of this question, what problem might get worse (compared to a "tradeable permit" pollution control system which had "hot spots")?

3. **[4 points]** Refer to Figure 2.

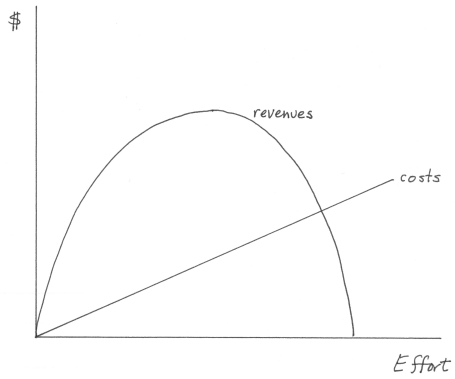

Figure 2

(a) What does this figure show?

(b) Where would the private-property optimum be?

(c) Where would the open access equilibrium be?

As always, explain your answers.

4. **[4 points]** Referring to Figure 3, briefly explain the large changes in the price of oil in the US in the early 1970's, the late 1970's, the mid 1980's, and the years before 2008. (Since the vertical axis is logarithmic, equal vertical distances imply equal proportional changes in the price of oil (in 2017 dollars).)

5. **[5 points]** If firms obey the Hotelling Rule, describe the time path of:

   (a) marginal profit;

   (b) profit;

   (c) quantity of output;

   (d) price of output.

   As always, explain your answers.

6. **[4 points]** Explain one economic incentive instrument other than a "deposit-refund system" that could be used to control municipal solid waste. Explain how it would work.

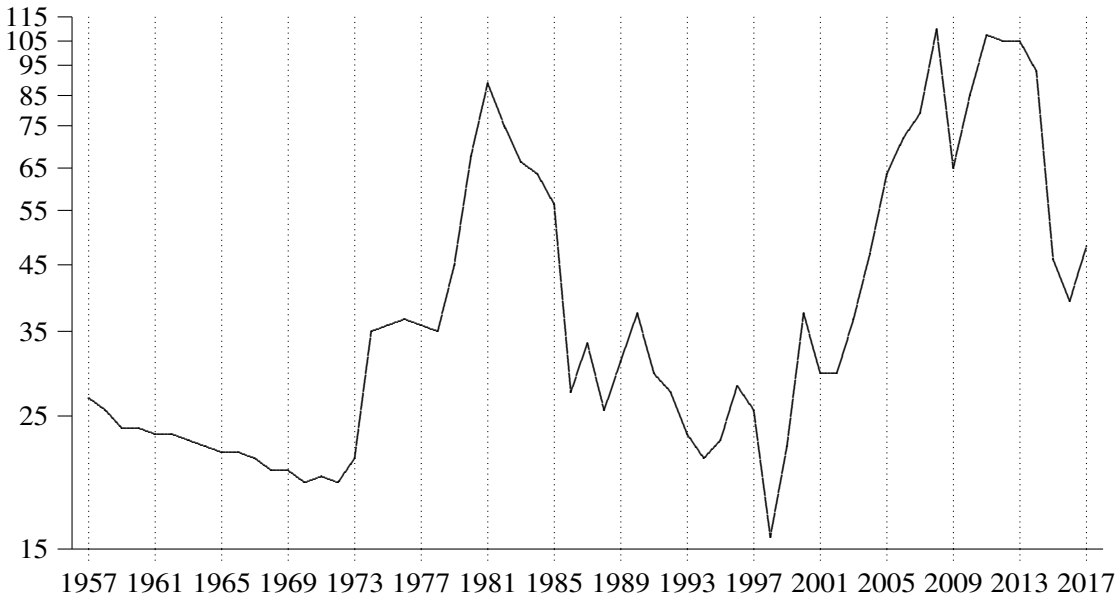

Figure 3. Vertical axis: price of oil per barrel in the US, all years translated into 2017 dollars (using for the measure of inflation the Consumer Price Index Less Food and Energy, the so-called "core" measure of inflation); logarithmic scale. Horizontal axis: year.

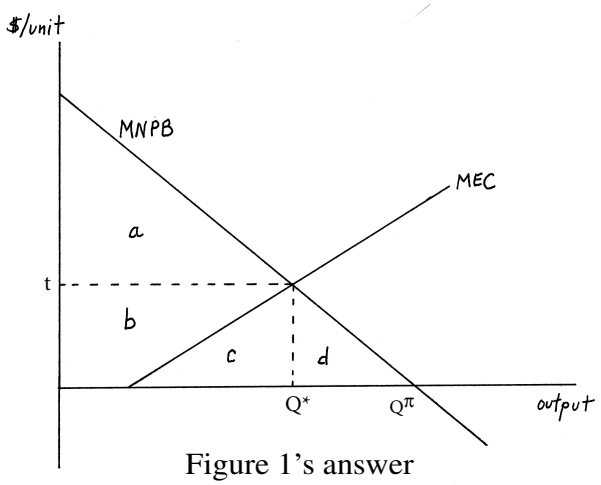

Figure 1's answer

Answers to Exam 2, Econ. 3250, Spring 2018

1. (a) If there is no government regulation, output occurs at Q^{π} in Figure 1's answer, where the MNPB ("marginal net private benefit") line intersects the horizontal axis. NPB ("net private benefit") is the area under MNPB, just like all "total" measures are the area under their corresponding "marginal" curves. So a, b, c, and d are all NPB, which is firm profit.

   (b) If the government imposes an optimal pollution tax, it will be at t in the figure, where the vertical line separating a from b intersects the vertical axis (where MNPB equals MEC ("marginal external cost")). From the MNPB curve, the response to the tax by the firms will be to produce at Q^*. The tax revenue is the tax rate, t, times the quantity of output, Q^*, so the areas b plus c. Area d is lost because output does not go past Q^*. Only area a is left for NPB.

   (c) Under socially-optimal "command and control," output is Q^*, but there is no tax. So a plus b plus c is NPB and d is lost because output does not go past Q^*.

2. (a) A "hot spot" is a small area of highly concentrated pollution. With, for example, a nation-wide tradeable permit system, it would be possible for most or all of the permits to be purchased by polluters in one small part of the country. That small area would become a pollution hot spot, with pollution levels above

the socially-optimal level there, even though the nationwide pollution total would be equal to the nationwide socially-optimal level. Dividing the tradeable permit markets into smaller geographical areas—for example, having separate pollution licenses valid only in single U.S. states—could eliminate hot spots.

(b) While dividing the tradeable permit markets into smaller geographical areas helps the "hot spot" problem, it shrinks the number of polluters in a given market. This could give those polluters "market power" in the selling of permits, where "market power" means non-perfectly-competitive power of existing pollution permit holders to influence the price of permits, or to whom permits are sold. In a tradeable permit system, incumbent firms could conspire to use their market power to greatly increase their industry's barriers to entry ("costs incurred by a new firm which is trying to enter a market") by refusing to sell pollution permits to potential entrants, or by conspiring to raise the pollution permits' price.

3. (a) The figure shows fishing effort on the horizontal axis and dollars of total revenue and total cost on the vertical axis, assuming a steady state in the fishery. The unusual shape of the total revenue curve comes from the biological mechanics we studied in the run-up to this figure: increasing effort at some point leads to a decrease in population size which is so great that the excess of births over natural deaths begins to shrink (due to lack of parent fish), and because a steady state is assumed, harvest has to begin shrinking as well.

(b) The private-property optimum would be at point E_1, because that maximizes profit, which is the gap between revenues and costs. At E_1, profit is π_1. Note that at E_1, the tangent line to revenue is parallel to the cost line; in other words, at E_1 marginal revenue (the slope of the revenue line) is equal to marginal cost (the slope of the cost line).

(c) The open access equilibrium would be at E_2, where profit is zero. To the left of E_2, profit is positive, so new firms would enter the fishery (or incumbent firms would have an incentive to fish more intensely), causing E to rise, so that would not be an equilibrium. To the right of E_2, profit is negative, so firms would exit the fishery (or incumbent firms would have an incentive to fish less

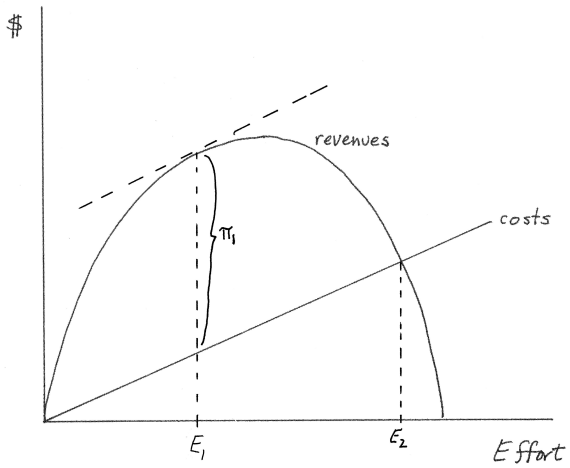

Figure 2's answer

intensely), causing E to fall, so that would not be an equilibrium either.

4. In 1973, the Arab members of the Organization of Petroleum Exporting Countries ("OPEC") refused to sell oil to major supporters of Israel during the "Yom Kippur War," including the US. This caused the first "oil price shock." See for example `https://en.wikipedia.org/wiki/1973_oil_crisis`.

   In 1979, the "second oil price shock" arrived with the collapse of the pro-US Iranian government of the Shah and its replacement with the Islamic Republic of Iran. Iran was a major oil exporter and its exports were greatly reduced during this time of great internal turbulence. See for example `https://en.wikipedia.org/wiki/1979_energy_crisis`.

   After 1979, the high oil prices elicited increased oil production, and prices began to fall. In 1986 they fell precipitously when Saudi Arabia, unhappy that they had had to produce less than their OPEC quota to compensate because other OPEC members were cheating by producing more than their OPEC quotas, suddenly increased its output all the way back to its OPEC quota. See `https://en.wikipedia.org/wiki/1980s_oil_glut`.

   Low oil prices in the mid-1980's to early 1990's induced rising demand for oil (for example, the increasing popularity of SUV's in the

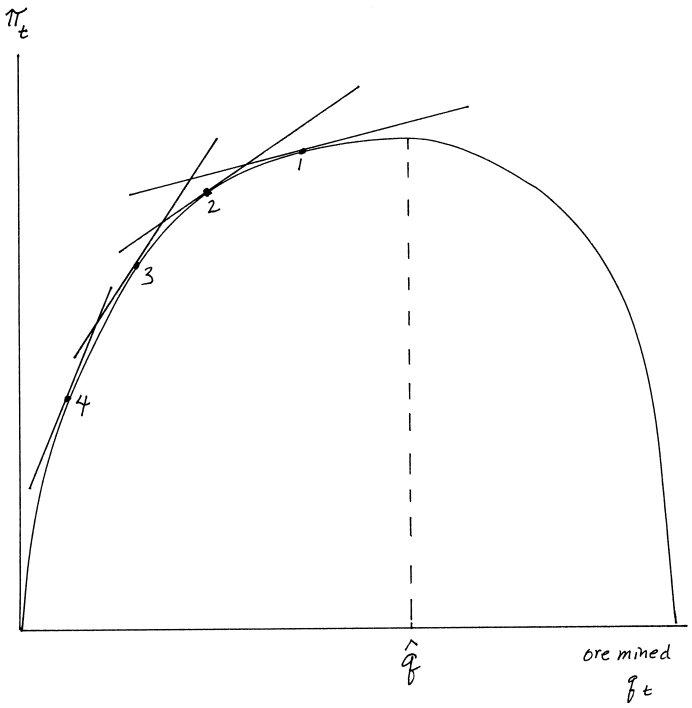

Figure 4

US). This, and the economic expansion of the mid-1990's to 2007, in turn caused rising prices. The start of the Great Recession in 2007/2008 caused a fall in the price of oil; competition from renewable sources of energy has tended to keep the price down as well.

5. Refer to Figure 4. Under the Hotelling Rule, marginal profit rises at the rate of interest. Marginal profit is the slope of the total profit curve given in the figure. To increase marginal profit (the slope of the tangent lines drawn in the figure), "ore mined" needs to fall, for example from the figure's point 1 to 2 to 3 to 4.

   (a) Marginal profit rises at the rate of interest.

   (b) As is evident from the figure, profit falls (a motion downward in the graph).

   (c) As is evident from the figure, output falls (a motion leftward in the graph).

(d) Consumers have downward-sloping demand curves, so part (c)'s fall in output is in equilibrium only consistent with a rise in price.

6. Brief answers: a materials levy (tax on raw materials used to make disposable items); a product charge (a tax on outputs which will have to be disposed of, with a higher tax the more burdensome proper disposal will be); and a waste disposal charge (a charge to use landfills). The book also speculates about the possibility of using marketable permits to limit municipal solid waste, but that is likely to be impractical.

   Of the above instruments, waste disposal charges are likely the easiest to evade, because to do so requires monitoring of illegal dumping anywhere by any consumers. Materials levies and product charges are imposed on manufacturers, who are much fewer in number than consumers and whose purchases and sales of commodities are rather easy to for governments to monitor—indeed in many countries, governments already monitor manufacturer's purchases and sales of commodities, for tax compliance.