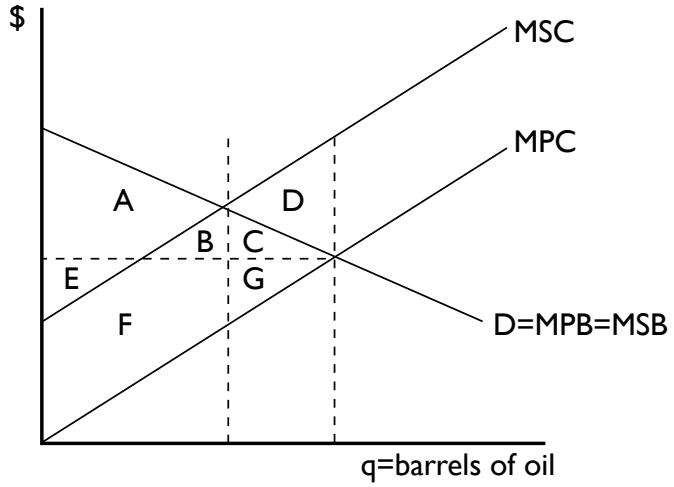
ECON 224, Professor Hogendorn

Problem Set 3

1. *Arctic.* Drilling for the oil in the Arctic regions of Alaska has been controversial because of negative externalities from pollution. Suppose that a very careful analysis of the region shows that the social and private cost and benefit curves look like the diagram below. (You can assume from here on that these curves are absolutely correct and there are no further externalities not accounted for below, though of course in real life things are not so simple.)



   (a) Assuming this market operates competitively and no one has a property right to pollute or be free from pollution, what quantity will be supplied and demanded? Using the labels *A*, *B*, *C*, etc., what will be the amount of private consumer surplus, private producer surplus, external costs of pollution, and deadweight loss?

   (b) One regulation would be for the government to prohibit Arctic drilling entirely, forcing quantity to $q = 0$. Relative to part

(a), what would be the gains and losses from this prohibition? Explain whether it would be good for social welfare to prohibit drilling (again, assuming the curves as drawn are correct).

(c) Suppose that the government allows drilling without any regulation, but no firm (not even one) chooses to exploit this market. All firms potentially involved announce that they cannot make a net profit. Add an average total cost (AC) curve to the diagram that would explain this decision, and explain what is happening. (Hint: remember that with rising marginal (private) costs, a correctly-drawn AC curve must cross the MC curve at its lowest point.)

2. *NaturalGasCoal.* There are two local electricity markets, one called Amherst which uses coal and one called Middletown which uses natural gas.

   Both markets face the same downward sloping demand curve that begins at price $q = 0$ and $p = \$180$ and falls to $q = 180$ and $p = 0$.

   Amherst has a horizontal marginal private cost curve $MPC = 15$.

   Middletown has a horizontal $MPC = 25$.

   (a) Draw two separate supply-and-demand diagrams for the two markets and label the private (i.e. competitive) equilibrium.

   (b) In Middletown, there are \$10 in external costs per unit of q due to carbon dioxide (global warming) emissions. Graph Middletown's marginal social cost curve and label its socially optimal amount of production.

   (c) In Amherst there are \$15 in external costs per unit of q due to the combination of several different types of pollution. Graph Amherst's marginal social cost curve and socially optimal point. Is Amherst's socially optimal production larger or smaller than Middletown's? Why?

(d) Suppose the government set a tax of \$10 per unit of q on the electricity production in *both* markets. Would this be socially optimal in these two markets? Would it create or remove deadweight loss? Illustrate on your two diagrams.

Review Problem, not to turn in

3. *SiliconValley.* In Silicon Valley, there are many information technology (IT) firms clustered in one place. This is usually attributed to positive externalities in production: when firm produces a product, the skilled workers can exchange ideas with one another, with venture capitalists, and so on. Thus, firms in Silicon Valley are more productive than similar firms elsewhere.

   (a) Graph the supply and demand curves for IT goods in Silicon Valley. Show the positive externality in production.

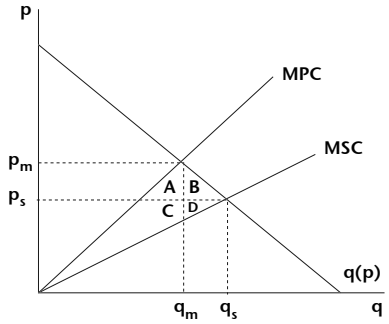
   (b) Label the graph to show the external benefits and the deadweight loss in both the free-market and the socially optimal situations.

   (c) If the California government were to intervene in this market, what should it do?

Answer to Review Problem:

4. *SiliconValley_a.*

   (a)



   (b) At the free market equilibrium, external benefits are $A + C$, and there is a deadweight loss $B + D$.

   At the social optimum, external benefits are $A + B + C + D$.

   (c) It could provide a subsidy so that the price of output fell to p_s in the graph. This would increase quantity demanded to q_s and correct for the externality.