## Possible Solutions for Homework 3

## **Economics of Sustainability**

## K Foster, Colin Powell School CCNY, Spring 2015

- 1. What are the names of people in your study group?
- 2. Provide some interesting and creative examples of
  - a. Negative externalities from consumption and social policies to affect these
  - b. Negative externalities from production and social policies to affect these
  - c. Positive externalities from consumption and social policies to affect these
  - d. Positive externalities from production and social policies to affect these

## Answers will vary.

- 3. Consider the market for a product with an output that pollutes the air. The industry's Supply curve (only including private internal costs) can be represented as  $Q_S = P_S$ . The demand can be approximated as  $Q_D = 80 P_D$ . The industry's marginal external costs from pollution occur as MEC = Q.
  - a. What is the privately chosen equilibrium quantity and price, when neither demanders nor suppliers take account of external costs?
     Set Qs = Qd and Ps = Pd and find where Q=P intersects with Q = 80 P; this is Q=P=40.
  - b. What is the MSC, the marginal social cost (the vertical sum of MC and MEC)? The vertical sum is MSC = Ps + MEC = Q + Q = 2Q.
  - c. What is the social optimum level of production of this good? What is the deadweight loss created by a lack of government action?
    The social optimum is where demand equals MSC, so where Q = 80 P intersects with P = 2Q. This is Q = 80/3 = 26.67. At this quantity the MSC is 53.33, which is 26.67 higher than the private supply curve. A graph shows the situation:



The DWL is the brown triangle, since at Q=40 the social cost is higher than what demanders value – they value it at only 40 but social marginal cost is 80. The triangle has area of .5(40 - 26.67)(80 - 40) = 266.67.

d. Suppose the government introduced a tax (per unit of output) to try to move closer to optimum. (Recall that this means that  $P_D = P_S + Tax$ .) What tax would reduce DWL the most?

A tax equal to the MSC at the social optimum (so 26.67) would work. From Pd = Ps + Tax substitute in (80 - Q) = (Q) + 26.67, and Q = 26.67. Demanders pay 53.33 but suppliers only get 26.67.

Note that this level tax (when MSC changes with level of output) means that if demand changes (if it were 81-Q or 79-Q), then the tax will no longer quite eliminate the DWL. If the tax were proportional to the total quantity sold, that would be better (but tough to legislate!).

- e. If the government instead restricted the level of output through regulation, what regulation should be set?
  If the government set a cap that only 26.67 total units of output could be produced, that would also eliminate DWL. Again, if demand changed then there would be DWL.
- f. Can you suggest any alternate policies (perhaps a tax on production over a particular level)?
   Answers will vary.