Homework 2
Due Tuesday February 18, 2014
Economics of Sustainability
K Foster, Colin Powell School CCNY, Spring 2014

You are encouraged to form study groups to work on these problems. However each student must hand in a separate assignment: the group can work together to discuss the papers and comment on drafts, but each study group member must write it up herself/himself. When emailing assignments, please include your name and the assignment number as part of the filename.

Please write the names of your study group members at the beginning of your homework to acknowledge their contributions.

1. 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 $Q_S = 2P_S$. The demand can be approximated as $Q_D = 100 - 2P_D$. The industry's marginal external costs from pollution occur as $MEC = Q - 5$ whenever $Q$, the quantity produced, is greater than 5.
   a. What is the privately chosen equilibrium quantity and price, when neither demanders nor suppliers take account of external costs?
   b. What is the MSC, the marginal social cost (the vertical sum of MC and MEC)?
   c. What is the social optimum level of production of this good? What is the deadweight loss created by a lack of government action?
   d. Suppose the government introduced a tax (per unit of output) to try to move closer to optimum. (Recall that this means that $P_D = P_S + \text{Tax}$.) What tax would reduce DWL the most?
   e. If the government instead restricted the level of output through regulation, what regulation would be set?
   f. If demand for this product suddenly rose so $Q_D = 120 - 2P_D$, what would be the effect of the tax that was imposed above? Is there DWL now? What about with the regulation?

2. Look at costs over time. Suppose a consumer is choosing between two vehicles, one that gets 20 mpg and the other that gets 35 mpg. A typical vehicle is driven about 12,000 miles per year. The consumer expects the car to last for 8 years.
   a. At current gasoline prices, how much additional money would be paid in gas for the lower-mileage vehicle?
   b. If interest rates are 2%, what is the present discounted value of these additional gas expenditures? If interest rates are 7%?

3. Consider a gas well that is being considered for production. For simplicity, assume that all costs must be paid now but revenues generated only when the natural gas is produced, seven years into the future. Suppose that in the first month the well
produces 1m cubic feet/day but then production falls by 5% in each subsequent month. Assume that the well is shut once production falls below 50,000 cubic feet/day. Find current prices of natural gas and assume these continue into the future. What is the present value of well production, if interest rates are 2%? If interest rates are 5%? If interest rates are 10%?

Hint: You'll probably want to do this with Excel, something like this...

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Gas/day</th>
<th>Days</th>
<th>Total Gas in Month</th>
<th>Revenue</th>
<th>Discount Factor</th>
<th>PV of Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1</td>
<td>1000000</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>950000</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>