WUR/EEES 21306
David Zetland
Homework 7&8
Due: Nov 29 (before class)
5 points per question
10 points total

7. A firm emits $M > 0$ tons of pollutants. The benefit function of the firm (in \$) is $B(M) = 30M - M^2$. The damage from pollutants to society (in \$) is $D(M) = 0.5M^2$.

   (a) Assume that the firm maximizes its (private) profit without considering social costs. How many tons of M does it emit?
   Answer: Set $\frac{\partial B(M)}{\partial M} = 0 \Rightarrow 30 - 2M = 0 \Rightarrow M = 15$.

   (b) What is the socially optimal level of M, i.e., considering both private and social benefits and costs.
   Answer: Set $\frac{\partial B(M) - D(M)}{\partial M} = 0 \Rightarrow 30 - 3M = 0 \Rightarrow M = 10$.

   (c) What tax rate (\$/ton) should the government use to attain this level of emissions.
   Answer: This answer is trickier than I wanted. There are two taxes that can "attain this level of emissions." The first is a simple tax of \$10 per ton that will reduce M from 15 to 10, i.e., $B(M) = 30M - M^2 - 10M$ leads to $M = 10$ after optimization. This tax is set equal to marginal damage ($1M$) at the socially-beneficial output of 10 tons, or $1(10) = \$10$. The second answer – setting the tax equal to the damage function ($0.5M^2$) to internalize the (varying) cost of the externality – is more general, since it can be used for ALL benefit functions. Either answer is acceptable.

   (d) What are the private and social net benefits before and after the tax?
   Answer: No tax: Plug $M = 15$ into $B(M)$ and $B(M) - D(M)$ functions to get 225 (private) and 112.50 (social). Tax: Plug $M = 10$ into $B(M) - 10M$ and $B(M) - D(M)$ functions to get 100 (private) and 150 (social).

   (e) How much tax revenue does the regulator collect?
   Answer: \$10 per ton for 10 tons gives \$100. NB: tax transfers do NOT affect social surplus.

8. You are using an Excel spreadsheet to decide how to allocate your time and money. Youre thinking of going to graduate school for three years at a cost of EUR 5,000 per year in cash plus EUR 15,000 per year of foregone net earnings. If you do so, you will increase your earnings (net of taxes) by EUR 15,000 per year for the five years after graduation.

   (a) Assuming a discount rate of 5 percent, should you go to graduate school? Show your numbers. (NB: All spending/earning starts NEXT year, but calculate values in today's money.)
   Answer: (1.5 pts) Ignoring fractions, the NPV is EUR 1,635 (see spreadsheet), a positive number that implies you should go to school.

   (b) Now you have a talk with your friend, who tells you that school is really much more fun than work. This talk leads you to assign an additional EUR 5,000 in value to your school years. His talk also makes you reconsider your job ideal of a high-paying job after graduation (money isnt everything!), so you are looking at making only EUR 5,000 per year of extra money. Should you go to graduate school? Show your numbers.
   Answer: (1.5 pts) Ignoring fractions, the NPV is EUR -22,149 (see spreadsheet), a negative number that implies you should go party.

   (c) After completing this tedious but rewarding calculation, you are approached by a consulting firm that wants you to write a report on the impact of climate change on education. They are worried that some impatient students will see climate change as an end of the world scenario and drop out of school to party. Is the discount rate of those students higher or lower than yours? Explain your choice.
   Answer: (1 pt) Higher, since they put less weight on the future.

   (d) The consultants also want you to interpret a report saying that only the best prepared people, governments and countries will survive the turmoil of climate change. Does that imply a discount rate thats higher or lower than yours? If the Dutch government wants to move people towards that discount rate, then what are TWO ideas that it can use to promote that sort of long term thinking? (This is an open ended question.)
   Answer: (1 pt) Lower. [No key for ideas. I want to see creative thinking. On the other hand, repeating "one must think about the future" does not give you points.