EC1340-Fall 2019
Problem Set 10

(Updated 21 August 2019)

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When you write up your answers, your goals should be to (1) be correct, and (2) convince your reader that your answer is correct. It is always helpful if your work is legible and if all steps are presented, possibly with a line of explanation.

In the case of empirical exercises, your goal should be to provide enough information to allow a reader to replicate your answer. This requires a description of data and data sources as well as a description of your analysis of the data.

Answers which do not achieve these goals will not be awarded full credit.

To assist us in complying with the University's privacy policy, the first page of each problem set should be blank except for your name and the problem set number. This will allow us to write your score inside your problem set. Failure to include such a page will be understood as permission to write your score on the front of your problem set where others might accidentally see it.

Problems

1. Let $C(x,\phi)$ denote a firm's cost of abating pollution to level x, where $c(\bar{x},\phi) = 0$, $c(0,\phi) > 0$, and $c_x < 0$. ϕ is a variable that affect the firm's costs. This parameter is known to the firm, but is uncertain for the planner. Let $D(x)$ denote the social damage caused by pollution level x. Finally, let $P(x;s,l,p) = sx + p\max[x - l,0]$ be the penalty function that the planner uses to regulate pollution. Thus, the planner's problem is

$$\min_x E[D(x) + C(x,\phi)]$$

and the firm's problem is

$$\min_x P(x) + C(x,\phi).$$

Let $C(x,\phi) = 10 - \phi x - \frac{1}{2}x^2$ and ϕ be one or zero with equal probability. Let $D(x) = \frac{11}{10}x + \frac{1}{4}x^2$.

   (a) Solve graphically for the firm's response to $P(x;s,l,p)$.

   (b) Find the planner's optimum value of x for each value of ϕ.

   (c) Find the welfare maximizing choice(s) of s,l,p.