

Resource & Environmental Economics Field Examination

May 2017

Instructions:

- You have 4 hours to complete the exam. This time commences at the end of the 15-minute reading period during which no writing is allowed.
- Please use your assigned "alpha letter" on every page to identify your exam. Do not use your name or social security number. Write on only one side of the page leaving at least one inch margins. Number each page, and make sure the pages are in order.
- You have four questions to answer.

Answer any four of the following five questions.

1. Suppose you are looking at groundwater use in a region where:

- all users draw from a highly permeable aquifer, where in the long run use by any one party does have a discernable effect on the total available stock;
- all users have Texas style “Right of capture” groundwater rights and thus can pump as much as they want from under their land;
- the aquifer does not recharge; and
- users of the aquifer must pay for their own pumping costs, but face no other cost associated with water use.

A local politician has alleged the aquifer is being depleted “too fast” and you have been hired to report back to the local government on this issue. Explain how you would address each of the following in your report:

- a. Explain how you would evaluate whether the aquifer is being depleted “too fast.” Your answer should include a parsimonious mathematical model and a description of the issue in words that would be understandable to a non-economist, but it should explain what “too fast” means from an economic perspective.
- b. Based on economic theory and the conditions for pumping laid out above, would you expect the aquifer to be used “too fast”? Why or why not?
- c. Suggest two approaches that might be used by the policy maker to improve use of the aquifer.

2. Suppose you obtain a job after graduation with a consulting firm that helps environmental agencies assess large-scale benefit-cost analysis. You are given the assignment of assessing whether the net benefits of hydraulic fracturing (fracking) are positive. Fracking involves injection of fluids and horizontal drilling, and has led to huge increases in the quantity of natural gas and oil, mostly in the U.S. The fracking process is thought to possibly lead to several environmental impacts. Assume you have a large enough consulting budget to be able to do more than just back-of-the-envelope types of research.

- a) Outline the major categories of benefits and costs that you will need to assess.
- b) Describe how you will try to ascertain the potential benefits and costs related to global warming.
- c) Suppose that physical scientists tell you that water quality related impacts remain uncertain at this point in time. Describe how you will deal with this uncertainty in your calculation.
- d) Finally, from the perspective of the usual formal goals of economic efficiency, is there anything lacking in just checking to see if net benefits are positive?

3. In an effort to reduce household energy use, Bryan Texas Utilities (BTU) commissioned an energy efficient lighting experiment. BTU assigns 5,000 households randomly, and evenly, to treatment and control groups. BTU delivers a free package of energy efficient bulbs to each household in the treatment group and does not deliver anything to the control group. BTU has

collected data on energy consumption for all 5,000 households in the experiment. Unfortunately, compliance was not perfect. Only 30 percent of the treatment group participated in the experiment and the rest of the treatment group threw away their package of energy efficient bulbs.

(a) Describe in detail two methods to estimate the causal effect of energy efficient lighting on energy consumption using these data. Your descriptions should include the assumptions required for each method. Describe how these estimates would differ, if at all, from the average treatment effect.

(b) How would your answer to (a) change if you found out some households in the control group stole packages of energy efficient bulbs from the delivery truck and installed those bulbs in their homes?

4. Suppose you are contacted by a graduate student who is trying to understand some statements that they have heard about climate change which are attributed to you or others. In particular, they are asking about the following statements:
- a) The yield depressing effects of climate change can improve farm producers' welfare.
 - b) One cannot predict all of the appropriate crop mixes and production factor usage related to climate change adaptations by looking at historical crop mix choices.
 - c) The appropriate level of climate change mitigation action is heavily influenced by the discount rate, with analysts who assume low discount rates recommending more immediate mitigation action.

Using economic theory give a short justification for each statement.

5. Is “Hotelling’s rule” (of optimal natural resource extraction) relevant to the analysis of environmental and natural resource management problems we face today? Be thinking of examples related to extraction of groundwater, oil, natural gas, and coal in a variety of settings.

In your answer be sure to provide a clear explanation of what is meant by “Hotelling’s rule,” and discuss why it is or is not relevant in analyzing specific issues. Is there evidence that “Hotelling’s rule” is observed in today’s “real world”?