

Resource & Environmental Economics Field Examination

January 9, 2014

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 four of the five questions.

1. There is growing desire to control agriculturally caused water pollution and rising awareness that farmers can reduce nutrient pollution by changing their land management practices. Although such management changes are costly, it is widely believed that they are less expensive than other available policies for improving water quality. There are, however, numerous difficulties that must be overcome. Among these, consider two. First, it is difficult to measure the environmental benefits that are actually achieved by such changes in management. Second, nutrient runoff varies greatly during a year and from one year to the next depending on weather and land use.
 - a. Develop a conceptual model that could be used to study the economics of water pollution in which some of the pollution comes from regulated industrial sources and some comes from agriculture.
 - b. Using your model, explain the relative merits of at least two alternative policies, including command and control as one of the options. Explicitly address the two difficulties mentioned above.
 - c. Expanding on your answer in b, explain how an empirical study might be developed to help policy makers identify the best policy response in a specific watershed. Clearly explain the kind of analysis that you believe should be carried out (e.g., econometric, simulation modeling, experiments) and what kind of data might be required for your analysis.

2. Suppose that the U.S. has decided to incentivize greenhouse gas emission reductions. The new policy is being written by an economist who seeks to maximize the present value of net benefits. For this question, you can assume that there is no uncertainty.
 - a. In general terms, describe the optimization problem that would be solved by the economist assuming a cap-and-trade type approach to solving the problem. Be sure to identify the key state and control variables that would be included in the economist's model. Using your model, under what general conditions would the optimal cap change over time?
 - b. In general terms, describe the optimization problem that would be solved by the economist assuming a carbon tax will be used. Be sure to identify the key state and control variables that would be included in the economist's model. Using your model, under what general conditions would the optimal tax rate to change over time? How and why or why not?
 - c. Draw general conclusions about what this might mean for policy in the "real world."
 - d. Expanding on your analysis above, how would the optimal policy in the U.S. be affected by exogenous changes in emissions from the rest of the world?

3. A particular region is rapidly developing irrigation from an exhaustible underground water supply. This development is progressing at a rate commensurate with a relatively high internal rate of return expected by agricultural producers, and current policy (open access) endows individual irrigators with the authority to make any pumping decisions they desire. At current rates of extraction, it is projected that by period T_1 the water supply will be exhausted to the point where further use is no longer profitable.

Employ appropriate economic theory and tools in producing responses to the following questions.

Under what conditions would a slower rate of irrigation pumping than is currently occurring be socially optimal? If institutional changes are imposed in a way that replaces the current open access policy, what might the policy options be? What are the economic requirements to insure no loss of welfare due to policy change, and can we expect these requirements to be met?

4. The primary criticism of stated choice methods of nonmarket valuation is that these involve hypothetical scenarios.
 - a. Join the attack on stated choice methods, providing examples of at least two general types of stated choice models (not two applications of the same method), and explain why economists should waste little time doing such analysis.
 - b. Oppose the attack, and defend stated choice methods. Why should they be used? When should they be used? Are they valid? Why? Explain while addressing limitations.
 - c. Describe a research problem for which you believe that stated choice methods are well suited. For this problem, what do you believe should be done to minimize vulnerabilities to applicable criticisms.
5. Climate change is influencing the accumulation of mountainous snow pack and the subsequent timing of water runoff. There is a diminishing amount of precipitation falling as snow and being stored in frozen form. Moreover, snow is melting earlier in the year. These effects are changing the seasonality of river flows and reducing water availability during the hotter months of the year.
 - a. Present a theoretical model for the foundation of a study in which you value the costs of these water flow changes. How would you design an economic study to estimate the costs in a single small country?
 - b. How would you evaluate the benefits of added river storage (reservoirs) under these conditions?
 - c. If earlier planting dates for crops become attractive with altered water flows, what would be the appropriate way to incorporate such changes in the above valuation studies?