

Resource & Environmental Economics Field Examination

January 10, 2019

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 five questions.

1. Suppose there is a groundwater contamination issue that might affect a community. Scientists who study the issue believe the contamination is a threat, but there is a substantial amount of uncertainty in their estimates of the danger. Some people in the community (group A) are very frightened and are demanding that the government immediately move to do clean up. Others (group B) think the scare is overblown, so they favor a wait and see approach.

Describe and lay out a model (including the appropriate welfare measures) that the government could use to ascertain the net benefits of doing clean up, given the uncertainty of the situation and the different beliefs about the probability that the contamination will be harmful. In your description, be sure to explain whether the government should pay attention to group A's risk assessment or group B's, or both, or whether they should just disregard each group's opinions, and pay attention to the best available expert science. Describe who bears the cost of risk protection in your cases to be considered.

2. Since 2000, Texas has monitored toxic emissions by chemical plants and issued fines for emissions exceeding the legal threshold. Suppose that in 2010 Texas enacted a policy to reduce emissions by chemical plants by increasing the toxic emissions fine for those plants by 50%. The penalties for all other industrial sources were unchanged.

The Governor's office now asks you to estimate the effect of this 2010 policy change on emissions by chemical plants. You are given a panel data set for years from 2000 through 2017 with the annual emissions fines ($Fines_{it}$) of chemical plants in Texas ($i = 1$) and Louisiana ($i = 2$), where there was no policy change.

- a) Two methods are suggested to estimate the policy effect: (i) compare fines on chemical plants in Texas before and after the policy and (ii) compare fines on chemical plants in Texas after the policy change to those in Louisiana after the policy. Carefully explain why both of those methods could give biased estimates of the policy's impact.
- b) Using only the data described above, what method would you suggest using to estimate the 2010 policy effect? Describe the model in detail. Include a description of the necessary assumptions. How does this model address the concerns you expressed in part a)?
- c) What, if any, threats are there to the validity of this model?
- d) Suppose that you are also given data on fines for other industrial toxic emissions sources in Texas and Louisiana. Propose a model that uses these data to address the threats to validity you described in part c).

3. Horseshoe crabs, historically used as fish bait or ground up for use as fertilizer, have become protected species after the medical industry discovered, in the early 1990s, that the blood of the horseshoe crab contains a very valuable protein that can be used to test drugs for their safety. Medical companies now hire local fishermen to collect and carefully transport the crabs to medical centers, where the crabs' blood is harvested, and then return the crabs back to the sea.

The horseshoe crab population is also important for Red Knots – migratory shorebirds that travel each year from the Arctic circle to the southernmost tip of South America. During their migratory voyage, Red Knots stop in the Delaware Bay to feed on protein-rich eggs of horseshoe crabs. Medical harvesting of horseshoe crabs had reduced the amount of food available to the migrating birds, leading to their listing status as federally threatened in the U.S. in 2014. Recently, several companies began developing a synthetic version of the protein found in the horseshoe crab's blood. If this synthetic protein proves to be effective, horseshoe crabs will no longer be harvested for medical purposes.

The Atlantic States Marine Fisheries Commission hires you as a consultant. Your task is to help the Commission figure out whether the crab should remain protected and to determine the number of crabs than can be commercially taken per year.

- a) If the synthetic protein proves to be effective, describe how you would go about figuring out whether or not the crab should remain protected. (Note: the crabs are not protected under the Endangered Species Act; rather, they are protected regionally in part because of their high financial value to the biomedical industry.)
 - b) Suppose the U.S. government decides that the crab should keep its protected status. Outline how you would estimate the optimal level of protection—that is, how would you determine the optimal annual catch rates? Be sure to define what “optimal” means in this context.
 - c) Now suppose the U.S. government decides to rescind the crab's protected status and asks you to help develop an alternate policy that would help sustain the welfare of the migrating birds. Describe such a policy, and how and where it could be implemented.
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4. Consider the management of a fishery that is used by N commercial fishermen. The rate of growth is a function, $g(\cdot)$, of the stock, x_t , and the rate at which fish are harvested by the fishers. The rate at which the i^{th} fisher harvests fish is a function, $f_i(\cdot)$, of the stock at that time and the amount of effort that the fisher employs, e_{it} . Effort must be purchased by the fishers at a cost of w per unit of effort. They sell a harvested fish at price p .
 - a) Under what conditions would a deregulated fishery lead to the socially optimal level of extraction from the fish stock?
 - b) Under what conditions could a tax on harvests lead to the socially optimal use of the fishery?

- c) Describe a tradable rights program that might be used to improve use of the fishery and show why this program might improve the efficiency of the fishery.
5. France is revising the boundaries of its Champagne region to keep up with growing international demand for Champagne wines. 40 towns are being considered for inclusion in the 319-town region, and two towns are at risk being excluded. The Champagne designation is very valuable. Land within the region is valued at almost \$1million/acre, while land outside the region's borders is valued at about \$5,000/acre.
- a) The final decision for whether or not to expand the Champagne region will be based on a vote by the regulator and all towns within five kilometers of the region's boundary—i.e., towns currently within the region, towns being considered for inclusion, and some nearby towns not being considered for inclusion. The regulator weakly prefers expansion and his vote counts for a 50 percent share of the total. Discuss which way the vote is likely to go and why. In your answer, be sure to outline the different factions that would arise in favor and against the expansion, and what non-market tactics each group might resort to in order to influence the outcome of the vote. Be as detailed as possible.
- b) If instead of a vote, the expansion decision was left to a mutual negotiation between the current and potential Champagne towns, would you expect a different outcome than the one you predicted in a)? Why or why not? Describe the potential challenges that may arise during such a negotiation. Under what conditions would the negotiation yield an expansion and under what conditions would the expansion plan fail?