

Answers to mid-term exam

Each section is worth 80 points, as detailed below.

1. Give short answers (about 3 - 4 sentences) to *five of the seven* following questions:

Each question is worth 4 points

a. Why is the choice of the discount rate the critical choice for climate policy?

Even a small difference in the discount rate change dramatically the NPF of climate policy, because benefits far in the future will soon have a PV close to zero if the discount rate is appreciably about 1 or 2 percent.

b. How do fisheries policies in Australia illustrate the importance of property rights in environmental policy?

As we saw in the NYT policy, the ITQ policy and the tuna 'ranches' give fishers the right incentive to preserve the value of their fishery. This contrasts with what we saw with the lobster fishery off of Rhode Island.

c. Why do advocates of neoclassical sustainability believe that the growth of NNW is the proper discount rate for making policy decisions?

As we discussed in class, the growth of NNW is the right measure of the opportunity cost of resources in the economy - correctly adjusted for externalities, etc.

d. What was the nature of the bet between Paul Ehrlich and Julian Simon, and who won?

That the (real) price of five precious metals would go up (Ehrlich) or down (Simon) over ten years. Simon won the bet.

e. What is resource rent, and what does Robert Solow advocate should be done with it?

Resource rent is the profit earned off of natural capital (oil, minerals, fishery, forest, etc.) Invest it in other forms of capital.

f. What is the fundamental disagreement that Jason Scorse has with Bill McKibben?

Jason thinks that Bill romanticizes the 'local' and that he underestimates the importance of international trade.

g. What is the IPAT equation, and what does it illustrate?

*Impact = Population * Affluence * Technology. It illustrates the joint impact of a population that is growing during a process of economic growth and technological innovation.*

2. Answer *one* of the following two questions (a or b):

a. Using a graphical model, illustrate the fisheries model highlighted in Appendix 3a of Goodstein' ("Overfishing, ITQs, and Aquaculture.") In doing so, address the following questions:

The proper graph and each question are worth 4 points

See the appendix for the proper graph.

- Why does the total revenue curve in this model have the shape that it does?

It is based on the natural growth of a fishery - also an inverted 'U,' as we showed in class.

- What is the difference (if any) between the maximum sustainable yield and the yield that maximizes a fishery's profits?

The MSY - the top of the inverted U - is the place where the growth of the fishery is maximized. The profit-maximizing yield - to the left of the MSY as long as MC is greater than 0 - is the place that maximizes the difference between TC and TR.

- Imagine that a technological innovation reduces the marginal cost of fishing: what will be the change (if any) of the profit-maximizing yield?

It would shift to the right, closer to the MSY

- If property rights regimes can improve the profits *and* the sustainability of fisheries, why is their resistance to such policies?

Transaction costs and the free-rider problem (as well as 'status quo bias.')

b. Using a graphical model, illustrate the Hotelling model highlighted in the Appendix 6A of Goodstein ("The Hotelling Model.") In doing so, address the following questions:

The proper graph and each question are worth 5 points

See the appendix for the proper graph.

- If interest rates are positive, why will there tend to be more extraction/use of a non-renewable resource in the present than in the future?

Because it makes more sense to extract now and then to earn the higher interest rate, acclimating more in the future than you would if you waited to harvest in the future.

- In equilibrium of the Hotelling model, why will the rate of return on capital (r) equal the changing value of the resource rent?

Because if they were not equal, you would invest more (if $r > \Delta RR$) or harvest more (if $r < \Delta RR$), until they became equal.

- What does the model predict will occur if r rises?

As suggested with the two answers above, you will harvest more - until r and ΔRR are back in equilibrium

3. The following data show the possibilities for the harvesting of a forest:

A correct table and each question are worth 4 points

# of loggers	Total harvest (in board-feet)	Total cost	Marginal revenue	Marginal cost	Profit	Average cost	Average revenue
0	0	0					
1	100	\$125	\$100	\$125	-\$25	\$125	\$100
2	250	\$250	\$150	\$125	\$0	\$125	\$125
3	450	\$375	\$200	\$125	\$75	\$125	\$150
4	650	\$500	\$200	\$125	\$150	\$125	\$163
5	800	\$625	\$150	\$125	\$175	\$125	\$160
6	900	\$750	\$100	\$125	\$150	\$125	\$150

7	950	\$875	\$50	\$125	\$75	\$125	\$136
8	1000	\$1,000	\$50	\$125	\$0	\$125	\$125
9	1000	\$1,125	\$0	\$125	-\$125	\$125	\$111
10	950	\$1,250	-\$50	\$125	-\$300	\$125	\$95

Each board-foot of wood sells for \$1.

- a. If this forest is owned by a single person, what will be the level of harvest? Justify your answer.

See calculations above - 5 loggers maximizes profits.

- b. If the forest is open-access, what will be the level of harvest? Justify your answer.

See calculations above - 8 loggers is where $AC = AR$ - which (as the model predicts) is where profits have been driven to zero.

- c. Imagine if the government wanted to manage this forest (following the efficiency standard), and it is open access. What policy would you recommend, and why?

They could do an ITQ policy or impose a fee that is less than \$35 and greater than \$25. With a fee in this range, there will be five loggers.

- d. Why do environmentalists, concerned with sustainability in forests and elsewhere, prefer low market interest rates to high market interest rates?

Lower rates mean that people will be less inclined to exhaust resources can reinvest the rent in financial assets.

4. Answer one of the following two questions (a or b):

The proper graph and each question are worth 5 points

- a. With a graphical model that has price/cost on the vertical axis and the appropriate quantity on the horizontal axis, illustrate and explain the following two conclusions from Larry Summer's infamous World Bank memo; then answer the final sub-question.

For the proper graph, see class notes and/or the corresponding graph in the Goodstein chapter.

- People in wealthy countries will be more concerned about the health consequences of hazardous wastes than will people in poor countries.

A shift out in WTP for pollution abatement

- If there are low transactions costs, there can be gains from trade in the exchange of hazardous waste between poor countries and rich countries.

As we showed in class and as shown by Goodstein, richer countries can export such waste and pay poorer countries, where each has a net benefit. In the rich country, the gain associated with pollution abatement will be greater than the payment to get rid of the waste; in the poor country, that same payment will be greater than the damages associated with waste.

- Can trade in hazardous waste ever be justified? Defend your answer.

Hard to justify, but can perhaps be justified if all parties are aware of the damages and these are not imposed in a significantly unequal way

b. The World Bank lends money to developing countries so that they can invest in public goods like roads, hospitals, and schools. Imagine that a World Bank project has the following expected costs and benefits:

The proper set-up and each question are worth 5 points

Cost in years in 2010, 2011, and 2012 are \$1,000,000

Benefits in years 2011 - 2016 are \$500,000

- Give a mathematical expression for the net present value of these expected costs and benefits

$$NPV = -\$1,000,000 - \$500,000/(1+r) - \$500,000/(1+r)^2 + \$500,000/(1+r)^3 + \$500,000/(1+r)^4 + \$500,000/(1+r)^5 + \$500,000/(1+r)^6$$

- If the World Bank uses a discount rate of 5%, what is the value of the net present value (i.e., solve the expression above)?

$$-\$321,546 = -1,000,000 - 476,191 - \$453,515 + \$431,919 + \$411,351 + \$391,763 + \$373,108.$$

- Would the borrowing country (e.g., Kenya, El Salvador, Indonesia) be likely to choose the same discount rate as the World Bank lenders? As ecologists? If

not, which discount rate should be chosen to assess whether the project should be approved or not? Defend your answer.

No and no: for the borrowing country, would depend on the opportunity cost of capital in the country; for ecologists, tend to be between 1% and 2%, as we have discussed. It depends really on your perspective: a good answer makes a case for one of these.