

Environmental Economics, Final Exam

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Name _____

Instructions: Answer all questions. Point for each question are given in brackets. Allocate your time accordingly. The exam carries a total of 60 points. Please stick to the point. Irrelevance will be penalised. Total time: 3 hours (but I do hope you don't need that much!).

1. Let $F(x)$ be a purely compensatory growth function for a renewable marine resource with stock x . Let $c(x)$ be the unit cost of harvesting, p the price of the harvested resource, and δ the discount rate.

- (a) (4) Suppose the equation

$$\delta = F'(x) - \frac{c'(x)}{p - c(x)} \quad (1)$$

has a unique solution x^* with the left-hand side less than the right-hand side for $x < x^*$. For $x^* > 0$, give an economic interpretation of (1) by showing that the right-hand side is a rate of return.

- (b) (3) Are there conditions under which the maximisation of sustainable yield is the optimal, or nearly optimal, policy? If so, what are they?
 - (c) (3) Write down two necessary conditions for extinction, one of which can be interpreted in terms of portfolio choice (and interpret it).
 - (d) (2) What is the relation between the private owner's problem and the outcome under open access? The range of parameter values under which extinction occurs is greater in which case?
2. Now suppose $F(x) = A$ in the relevant range of x , $c(x) = b - kx$, where $A, b, k > 0$ describes the model for groundwater management in the arid zones of India. Assume there is open access (for both parts of this question).
 - (a) (2) Under what condition will the aquifer be exhausted?
 - (b) (3) Assuming the condition for exhaustion from the previous part does not hold, will the equilibrium stock increase with an increase in (i) the natural rate of recharge, (ii) the price of water, (iii) the rate at which the average cost of extraction changes with the stock (i.e. k)?
 3. (6) What additional considerations have to be taken into account when considering the likelihood of extinction for terrestrial biological rather than marine biological resources? How do these considerations affect policies to avoid extinction?
 4. (a) (2) Write down the expression for the length of the set of stable states S in which only enforcers and cooperators are present in the Sethi and Somanathan (1996) model.
 - (b) (4) What can analysis of this expression tell you about the "crisis" in rural common property resources in India that Jodha describes in his paper?

- (c) (2) What important aspects of the crisis cannot be examined in the Sethi and Somanathan (1996) model?
5. (a) (5) Both Weitzman (2007) and Dasgupta (2006) criticize the Stern report for using a low discount rate r . However they disagree about the value of one of the parameters that determines r through the Ramsey equation, namely ρ . Which of them (if any) do you agree with? Why?
- (b) (5) What is the significance, in this debate, of the other parameter in the utility function that determines r ?
- (c) (5) Why does Weitzman say that Stern may be "right" after all (though for the wrong reasons)?
- (d) (4) Thomas Sterner and U. Martin Persson (2007), in their paper (which I did not assign in the reading list) "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate" argue that an important part of the problem of assessing damages from climate change is being missed in models which use a homogeneous consumption good. They present some results from a model with two goods that enter the utility function: consumption c , and environmental quality e . They point out that the marginal rate of substitution (or relative price) between these two goods will change in response to changes in their supplies in the future. How would you expect the relative abundance of these two goods to change in future? What will that do to the MRS, and therefore, to their shadow prices? And how will that affect the valuation of damages from climate change? Would you expect the value of damages to increase or decrease when this effect is taken into account?
6. Costs of reducing climate change.
- (a) (2) The major economic policy that has been proposed to reduce carbon emissions is to tax them (or equivalently to auction permits). This carries a benefit in terms of reduced risk from climate change, and a cost in terms of reduction of output that depends on emissions. It has been argued by some that pre-existing distortionary taxes in the labour market can reduce the cost of such a policy. What is this argument (in a line), and what is this effect called?
- (b) (2) The counter-argument is that pre-existing distortionary taxes can raise the cost of such a policy due to an additional effect. What is this called? Explain in a line. (No maths).
- (c) (2) How does the presence of positional externalities affect this debate?
- (d) (4) How does it affect the estimate of the costs of mitigation? Explain, making your assumptions clear.