

# AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative MA Programme in Economics for Anglophone Africa  
(Except Nigeria)

## JOINT FACILITY FOR ELECTIVES JULY – OCTOBER 2006

### ENVIRONMENTAL ECONOMICS II

#### Second Semester: Final Examination

**Time: 3 Hours**

**Friday, September 29, 2006**

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#### **INSTRUCTIONS:**

1. This examination has **FOUR** questions. Answer **ANY THREE** questions.
  2. All questions carry equal marks.
  3. Write legibly
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#### **Question One: Public Goods and Externalities**

**(20 marks)**

- (a) Some environmental amenities such as the water flow management, soil erosion management and nutrient recycling services of tropical forests have characteristics of public goods. Market provision of such public goods will generally be sub-optimal. Assume a society with  $n$  identical individuals, each of whom consumes two goods,  $x$  (a pure private good) and  $G$  (a pure public good that is excludable in production) and has an income of  $w$ . The individual's utility function is  $U(x,G)$  and well-behaved. Graphically characterise the Nash-Cournot market equilibrium in the provision of the public good and compare such equilibrium with the pareto-optimal provision of the public good. All graphs should be clearly explained. [10]
- (b) What is a transferable environmental externality? Formulate a simple two-agent model, where each agent selects a level of self-protection, to illustrate the sub-optimal effects of a transferable externality. Show the cooperative and non-cooperative solutions on a graph. [10]

#### **Question Two: Environmental Valuation Analysis**

**(20 marks)**

- (a) Explain, with illustrations and/or derivations, why the compensating surplus is an appropriate measure for capturing the change in welfare that would result from a change in the quality of an environmental resource. [10]

- (b) Suppose you are interested in applying the widely used zonal average version of the travel cost method (TCM). Assume that you have already used a survey instrument and collected the following data for Victoria Falls national park in Zimbabwe.

Zone	Total Number of Annual Visits from Zone $i$	Total Population in Zone $i$ (000s)	Travel Cost (\$) from Victoria Falls to Zone $i$ in km
1	14,000	2,000	10
2	18,000	3,000	12
3	22,000	4,000	13
4	25,000	5,000	14
5	36,000	8,000	15

One of the things that you have discovered during your field research in Zimbabwe is that there is no charge to enter Victoria Falls national park. Estimate the linear trip generating function. Given that the coordinates  $\{P;V\}$  of the surrogate demand function are  $\{0;115000\}$ ,  $\{5;60000\}$ ,  $\{10;9000\}$  and  $\{15;0\}$ , calculate the annual consumer surplus for the recreational experience. Be sure to state your assumptions clearly and show your working. [10]

**Question Three: Environmental Policy Instruments (20 marks)**

- (a) Assume there are several producers,  $i=1,2,\dots,n$ , who are generating some output,  $q_i$ , that can be sold at a fixed price,  $p$ , and can be produced at a cost,  $c_i(q_i)$ , where costs increase with increased output,  $dc_i/dq_i > 0$ . Segerson (1988) proposed an ambient charge scheme that combined penalties and rewards for exceeding or beating a specific level of total ambient concentrations. Illustrate the alternative ways in which the regulator can set the ambient charge to achieve the desired level of production. [10]
- (b) The simplest version of the Coase theorem is said to claim that a unique and efficient allocation of resources would follow from rational bargaining, irrespective of how property rights were initially allocated. Demonstrate that the distribution of net gains between bargaining parties will, in general, depend upon the initial distribution of property rights. [10]

**Question Four: International Environmental Issues (20 marks)**

- (a) Some commentators characterise the greenhouse effect as a classic Prisoner's Dilemma. Suppose that  $N$  countries have to choose between two strategies, namely *reducing GHG emissions* and *business as usual*. For the case where  $N=10$ , assume that each unit of pollution abatement comes at a cost of 5 to the abating country; it confers benefits of 3 to the abating country and to all other countries. Which outcome would you predict? Show your working. Comment on the implications of this result on the current empirical efforts to resolve the GHG effect. [10]
- (b) On a *a priori* basis can you determine the environmental effects of international trade? Is trade therefore good to the environment? Elaborate. [10]