

## ECO2118A – Assignment

Please note that your assignment is:

- I. Due on Monday July 11, 2016 at 11 pm.
- II. To be sent electronically to [cdong060@uottawa.ca](mailto:cdong060@uottawa.ca). Please cc your assignment to me at [mkhazabi@uottawa.ca](mailto:mkhazabi@uottawa.ca).
- III. Assignments received after 11 pm on July 11<sup>th</sup>, will be marked down 15% for each day late, down to a maximum of 70%
- IV. To be completed by you only. Academic fraud will not be tolerated.
- V. Worth 20% of your total mark.

Please address your questions or concerns directly to me at [mkhazabi@uottawa.ca](mailto:mkhazabi@uottawa.ca).

Good luck!

1. A chemical factory is located next to a farm. Airborne emissions from the chemical factory damage crops on the farm. The marginal benefits of emissions to the factory and the marginal costs of damage to the farmer are as follows:

Quantity of emission	100	200	300	400	500	600	700	800	900
Marginal benefit to factory (\$000)	320	280	240	200	160	120	80	40	0
Marginal cost to farmer (\$000)	110	130	150	170	190	210	230	250	270

From an economic point of view, what is the best solution to this environmental conflict of interest? How might this solution be achieved? How should considerations of efficiency and equity be balanced in this case?

Justify your answer using a graph and also a numerical argument.

2. Four towns share a common water source. By buying open land along the watershed (area from which the water flows) they can preserve its purity from sewage, road runoff, etc. The land demand schedule for each town based on water treatment costs saved can be expressed as:

$$P = \$34,000 - 10Q_d,$$

where  $Q_d$  is acres purchased, and  $P$  is the price the town would be willing to pay.

- If the cost of land is \$30,000 per acre, how much land will be purchased if each town operates independently? How much if they form a joint commission for land purchases? Show the situation graphically. (If the economic theory is not clear, imagine representatives of the four towns sitting around a table, discussing the costs and benefits of purchasing different amounts of land.)
- Which is the socially efficient solution and why? How would the answers change if the price of land were \$36,000 per acre?
- Discuss this in terms of the demand for clean water. Is clean water a public good in this case? Can water generally be considered to be a public good?

3. We can modify the inter-period allocation model to deal with the issue of intergenerational allocation of resources. Suppose a generation is thirty-five years, and we are concerned with only two generations. Demand and supply functions for oil in the present generation are given by:

Demand:  $Q_d = 200 - 5P$  or  $P = 40 - 0.2Q_d$

Supply:  $Q_s = 5P$  or  $P = 0.2Q_s$

- Draw a demand and supply graph showing the equilibrium price and quantity consumed in this generation in the absence of any consideration of the future. Now draw a graph showing the marginal net benefits from consumption in this period at all levels of consumption up to the equilibrium level. Express the net benefit (benefit minus cost) algebraically.
- Suppose that the net benefit function is expected to be the same for the next generation. But there is a discount rate (interest rate) of 4 percent per annum, which for thirty-five years works out to  $(1.04)^{35}$ , which is approximately equal to 4. Total oil supply for both generations is limited to 100 units. Calculate the efficient allocation of resources between the two generations and show this graphically.
- What is marginal user cost for this efficient allocation? If you include this user cost in your original supply and demand graph, what is the new equilibrium? If the demand curve is the same in the second generation, what will the price and quantity consumed in that period be?
- How would the answers differ if we used a zero discount rate? What can you conclude from this example about the general problem of allocation of resources over long periods?

4. The World Bank is considering an application from the country of Equatoria for a large dam project. Some costs and benefits of the project (dollar values) are as follows:

- a. Construction costs: \$500 million/year for three years
- b. operating costs: \$50 million/year
- c. Hydropower to be generated: 3 billion Kilowatt hours/year
- d. Price of electricity: \$0.05/Kilowatt hour
- e. Irrigation water available from dam: 5 billion gallons/year
- f. Price of water: \$0.02/gallon
- g. Agricultural product lost from flooded lands: \$45 million/year
- h. forest products lost from flooded lands: \$20 million/year

There are also additional, less easily quantifiable, losses: human costs to villagers who will be forced to move, watershed damage, and ecological costs of habitat destruction. It is also possible that the new lake area may contribute to the spread of water-borne diseases.

- Do a formal cost-benefit analysis using the quantifiable factors previously listed. Assume that the lifespan of the dam is 30 years. Assume that construction begins now (in Year 0). All other impacts start once the dam is completed (in Year 3) and continue for 30 years (until Year 32). Do a complete cost/benefit analysis for two possible interest rates: 10 percent and 5 percent. Do your figures indicate a definite “yes,” definite “no,” or uncertain result in each case?
- Now consider an alternative project: a number of smaller dams constructed so as not to flood significant agricultural or forest lands. For this project, total construction costs are exactly half the costs of the big dam project, and power/irrigation benefits are also half as much. But there is no damage to farmland or forest, and there are no ecological or resettlement costs. Evaluate this project, and compare it to the larger project at the two interest rates.