AAE / ECON / Env. St. 343
Environmental Economics

Homework #5
Suggested Solutions

Provide short answers to the 6 questions below. Required Readings:

Yardley, W. 2007. "Climate Change Adds Twist to Debate Over Dams." *The New York Times*, April 23.

1. Suppose that it is your intention to live the life of the philosopher-hermit soon after graduation from UW; you believe that the meaning of life truly can be found only after spending three years alone in the woods. It turns out, though, that even hermits have cash flow problems. To rent the appropriate cottage for your philosophizing will cost $3000 per year. Given that you plan on renting the cottage for three years, starting five years from now, how much money would you need to invest now if you can earn 4% on your money? What about 8%?

   The $3000 payments don't start until five years from now. So, to pay for the cottage in year 5 requires investing today the amount $3000(1+r)$^{-5}$; to pay for the cottage in year 6 requires investing today the amount $3000(1+r)$^{-6}$; to pay for the cottage in year 7 requires investing today the amount $3000(1+r)$^{-7}$.
   So, the result for 4% is:
   $PV = 3000(1.04^{-5} + 1.04^{-6} + 1.04^{-7}) = \$7116.59$
   The result for 8% is:
   $PV = 3000(1.08^{-5} + 1.08^{-6} + 1.08^{-7}) = \$5682.73$

2. Suppose the city of Madison is considering construction of a new park. The land is purchased in year zero (the current year) for $200,000. Also in year zero, development costs will be $300,000. Regular maintenance costs of $50,000 will start in year zero and continue forever. In addition, a one-time maintenance cost of $110,000 is incurred in year 1 only. Benefits of the park are in the form of higher home values and are estimated at $100,000 per year, and are obtained in year zero and continue forever. Madison's property tax revenues associated with homes near the park increase by $10,000 per year, and are obtained in year zero and continue forever. The discount rate is 10%. Assume all benefits and costs are measured accurately, and that there are no other benefits or costs. Will the park yield a potential Pareto improvement? Show your work.

   Let's first calculate the present value of the costs. Recall that $\sum_{t=1}^{\infty} \frac{1}{(1+r)^t} = \frac{1}{r}$.

   $$PV(Costs) = 200,000 + 300,000 + 50,000 + \frac{50,000}{0.1} + \frac{110,000}{1+0.1} = \$1{,}150{,}000$$

   For the benefits, we don't need to consider the taxes because those are a transfer.

$$PV(Benefits) = 100,000 + \frac{100,000}{0.1} = \$1,100,000$$

Thus, the net present value is NPV = −$50, 000. So, the park will not yield a Pareto improvement.

Questions 3 through 6 refer to the Yardley article on dam removal. For questions 3 and 4, indicate how the benefit or cost would be valued using market-based or non-market valuation techniques. Describe the type of data that would need to be collected and how it would be used in the analysis. Justify your choice of technique as the most appropriate for the benefit or cost under consideration.

3. Benefits from breaching the dams on the Klamath River.

Benefit	*Specific Benefit*	*Method / Data*
Increase in fish populations	*More profitable commercial salmon fishing industry*	*Increased producer surplus estimated using market prices*
	Recreational benefits to anglers (use value)	*Travel cost is appropriate for use values – survey data on recreational anglers*
	Recovery of an endangered species (non-use value)	*CVM is only method for non-use values – survey data on people's WTP to restore fish populations*

4. Costs of breaching the dams on the Klamath River.

Cost	*Specific Cost*	*Method / Data*
Loss of power production	*Increased energy costs to Northwest residents*	*Decreased consumer surplus estimated using market prices for electricity.*
Loss of irrigation water	*Increased production costs to local farmers*	*Decreased producer surplus estimated using market prices on farm products.*
Loss of "clean energy" if there is a resulting increase in energy from more polluting sources (e.g. coal)	*Increase in air pollution to Northwest residents / increase in climate change globally (decrease in a use value)*	*CVM – survey data on people's WTP/WTAC to reduce air pollution*

5. Given the information in the article, what impact would a high discount rate have on your calculation of the net present value (NPV) of dam removal? State your assumptions.

   The effect of the discount rate depends on the time flow of costs and benefits. If salmon recovery is a gradual process, then benefits are likely to increase over time. If electricity and agricultural prices remain high or decrease over time, and other "clean energy" becomes

more widely available in the future, then the costs are likely to be fairly constant or decreasing over time. However, if other "clean energy" sources do not become more widely available in the future, then costs could increase over time as air pollution gets worse.

Assumption #1: Benefits minus costs are increasing over time. Higher discount rates should reduce the NPV of dam removal because the higher future net benefits will be weighed less.

Assumption #2: Benefits minus costs are decreasing over time. Higher discount rates should increase the NPV of dam removal because the lower future net benefits will be weighed less.

6. Would sensitivity analysis be useful in estimating the net benefits of breaching dams on the Klamath river? Explain.

   Many important parameters that will influence the net benefits of breaching dams are uncertain in the future: electricity prices, agricultural prices, fish populations, the amount of future energy produced with low pollution, etc. Sensitivity analysis could be useful in exploring the effects of alternative assumptions associated with the above parameters on the net benefits of breaching dams.