

Environmental Economics (AAE / ECON / Env. St. 343)

Exam #2. Suggested Solutions

1. Consider the following statement: “Stated preference methods of valuation (e.g. contingent valuation) can be used to place economic value on any type of good.” If this statement is true, then why has so much effort been spent developing alternative valuation methods, such as revealed preference? Explain.

The contingent valuation method is a stated preference method that relies on hypothetical scenarios – what people say they will do – to estimate value, which can result in hypothetical bias. Further, the hypothetical nature of CVM has been criticized for providing value estimates that are insensitive to the amount of the environmental good being bid on, and estimates that embed preferences for the environment in general, and not the specific good being bid on. In contrast, revealed preference methods (hedonics, travel cost) are based on observed decisions of respondents, and thus are not subject to hypothetical bias when estimating use values.

2. The annual individual demand for fishing trips to Marion Lake has been estimated as $T = 8 - P + C$, where T is the number of trips, P is the price of a trip, and C is the catch rate in the lake. Suppose $P=4$, and a proposed sewage treatment plant would reduce pollution into the lake and increase C from 2 to 4. An angler’s annual fishing expenditures are defined as the price of a trip multiplied by the number of trips taken over the year. Using the above information, a colleague of yours quantifies an angler’s benefits from the treatment plant as equal to the increase in annual fishing expenditures when C increases from 2 to 4. Has your friend over or underestimated the benefits from the treatment plant? Show your work.

*First, the level of P that drives demand to zero is $P^c = \$10$ when $C=2$, and $P^c = \$12$ when $C=4$. Second, the trips demanded is $T=6$ when $C=2$, and $T=8$ when $C=4$. Third, expenditures are $6 * \$4 = \24 when $C=2$ and $8 * \$4 = \32 when $C=4$. Therefore, the colleague’s benefit estimate is \$8. The correct benefit estimate is the difference in consumer surplus*

$$\Delta CS = [(1/2)(\$12 - \$4)8] - [(1/2)(\$10 - \$4)6] = \$14$$

So, the colleague has underestimated the benefits from the sewage treatment plant by using expenditures rather than the change in consumer surplus.

3. Consider a lake shoreline with a paper mill that emits pollution into the lake. The only users of the lake are the shoreline residents, who also work at the mill. You are asked to use a revealed preference method to quantify the loss in non-market benefits derived from a recent mill expansion that increased the amount of pollution entering the lake. Briefly describe and justify the method and data you would use.

Since the mill likely emits pollution because it is costly to clean up, then pollution is productive for the mill. Therefore, pollution increases should be capitalized into higher wage rates after the expansion, because the mill must compensate workers to live near the mill rather than relocate to an area with less pollution. Further, since the only users of the lake are shoreline residents who work at the mill, a hedonic wage model is the most appropriate method. Data to be used would include wage rate data for the mill before and after the expansion, or wage rate data across multiple mills that reside on lakes with different pollution levels.

4. The Cheetah is a large cat that lives in Africa and is considered to be endangered because its habitat is being lost to agriculture and grazing land for cattle. Suppose a country with a Cheetah population is considering a law to protect Cheetah populations that is modeled off the United States Endangered Species Act. The new law would give the government the power to designate some areas as “critical Cheetah habitat”, allowing the government strict control over private land-use practices in areas with known Cheetah populations. At a Cheetah conservation conference, you argue that the new law could actually be counter-productive and reduce Cheetah populations. What is your reasoning? How would you propose amending the law to improve it? Explain.

As found in the Spotted Owl case study covered in class, it is likely the case that local farmers will bear the costs of conserving Cheetah populations by altering their land use, while the benefits will accrue to a much broader population since Cheetah conservation likely provides non-excludable non-use values. As covered in class, without compensation there is incentive for local farmers to destroy Cheetah habitat (e.g. by land-use conversion or direct hunting) before it is designated critical habitat by the government (i.e. the “shoot, shovel, and shutup” incentive). One solution is for the gainers to compensate the local farmers to provide incentive for them to conserve Cheetahs.

5. The government is trying to decide whether to allow oil drilling in the Caribou National Wildlife Area or preserve it as wilderness. Suppose that oil drilling will produce net revenues for several private firms, though drilling will reduce the recreational wilderness benefits from the Wildlife Area 20 years from now. The present value of the oil net revenues is \$400, and the expected loss in wildlife benefits 20 years from now is uncertain but is expected to be either \$1000 or \$2000. If the discount rate is 5%, could oil drilling achieve a Pareto Improvement? Show your work.

If drilling commences, the \$400 could be invested today at 5% return and result in \$1,061 in revenues 20 years from now. Therefore, if the lost wildlife benefits 20 years from now are \$1000, then the oil industry (the gainers) could compensate the recreationists (the losers) such that nobody is worse off, thereby achieving a Pareto Improvement. If the lost wildlife benefits are \$2000, then the costs of oil drilling exceed the benefits and a Pareto Improvement could not be achieved with oil drilling.

6. Suppose a federal flood control project is proposed, and you work for a consulting firm that has been asked to do a cost-benefit analysis of the project. The project generates benefits and costs over a 20-year time horizon. A colleague of yours evaluates the project using a discount rate of zero, and finds that the net present value of the project is positive. You approach your colleague about the discount rate. You want to use a different rate.

- a. Briefly explain to your colleague why they might not want to use a zero rate (Note: be as clear and concise as possible). 2 pts.

To obtain full credit, you must provide the rationale for discounting: either a “positive rate of time preference” rationale (people prefer to consume things now instead of later); or an “opportunity cost of foregone investment” rationale (a dollar today can be invested in productive enterprises to generate more than a dollar’s worth of output tomorrow).

- b. Is it possible that the net present value will always be positive no matter the choice of discount rate? Explain. 2 pts.

If the net benefits of the project are positive in each of the 20 years during the relevant horizon, then the net present value would always be positive, regardless of the choice of discount rate.

7. The United States Forest Service is considering a management plan (recreation and timber) for a particular forested area. Recreation would involve picnicking at a scenic overlook. Timber harvests would be restricted to an isolated area far removed from the recreation site; consequently the two uses do not conflict (the timber harvests do not reduce the value of picnicking). Consider the following data:

- Constructing a basic road into the forest leading to both the timber harvest site and the recreation site would cost \$10,000 in year 0.
- Strengthening an existing bridge to support logging trucks would cost \$2000 in year 0.
- A road spur (an addition to the basic road) to the scenic overlook and picnic area would cost \$12,000 in year 0;
- The net present value of all timber benefits from harvesting operations is \$11,000 (these net benefits account for all timber revenues and harvesting costs);
- The annual benefit of recreation is calculated to be \$2000; this benefit is expected to start in year 2 and continue forever;
- The discount rate is 10%.

The data above is a complete list of all benefits and costs. Given this data, you conduct a cost-benefit analysis. Which of the following options do you recommend? **Show your work.**

Option 1: Use the area for timber only.

Option 2: Use the area for recreation only.

Option 3: Use the area for both recreation and timber.

Option 4: None of the above.

Option 1: Costs = \$10000 + \$2000; Benefits = \$11000 => NPV = -\$1000

Option 2: Costs = \$10000 + \$12000; Benefits from an infinite stream of \$2000 payments is \$2000 + \$2000/0.1 = \$22,000, but if the benefits start in year 2, then Benefits = \$22,000 - \$2000 - \$2000/(1.1) = \$18,182 => NPV = -\$3818

Option 3: Costs = \$10000 + \$2000 + \$12000; Benefits = \$11000 + \$18182 => NPV = \$5182.

Option 4: NPV = \$0

So, options 1 and 2 are not preferred since they generate negative NPV. Option 3 provides a Potential Pareto Improvement over option 4, so option 3 is preferred on efficiency grounds.