

ENVIRON 805K Problem Set 3

Each sub-question is worth of 10 points.

1. John's utility function is described by

$$u(x_1, x_2) = 0.4 \ln x_1 + 0.6 \ln x_2,$$

where x_1 is the market good and x_2 is the personal environment. The price of the market good is normalized to \$1. The price of attaining one unit of environmental quality is \$2. John has a budget of \$25.

- (a) Please derive his marginal utility for market good and environment respectively.
- (b) Please write down his budget line.
- (c) Please derive the optimal choice for John.

2. Dan's utility function is described by

$$u(x, q) = xq,$$

where x is market good and q is personal environmental quality. Dan's initial consumption of market good and environment is $(6, q_0)$.

- (a) If the environmental quality changes from 3 to 4, what is Dan's willingness to pay?
- (b) If the environmental quality deteriorates from 4 to 3, what is Dan's willingness to accept for compensation?

(Hint: WTP and WTA can be measured in units of x .)

3. Housing price in a community at Kunshan can be described by the following model:

$$p_i = \beta_0 + \beta_1 \text{square meters}_i + \beta_2 \# \text{bedrooms}_i + \beta_3 \# \text{bathrooms}_i + \beta_4 \text{AQI}_i + \varepsilon_i$$

where p is house price, i indexes house, β is a set of parameters to be estimated, and ε is an unobserved error term. Kunshan has built a coal-fired power plant in this community, whose location is randomly selected. The houses that are close to the power plant have worse air quality. The simulated housing market data will be provided separately.

- (a) Please estimate the marginal cost of air pollution measured by one unit of AQI.
- (b) Please discuss whether the above hedonic price model reveals the causal relationship between air pollution and housing price.

4. Suppose one facemask costs \$ 1.5. Wearing a mask can reduce the risk level from 8×10^{-7} to 6×10^{-7} . Please calculate the Value of a Statistical Life.
5. The demand function for a beach in California is described by $v = 4 - 2p_v + 3q + 2y$. In this form, v is the number of visits per year, p_v is cost per visit, q is water quality, and y is income. Suppose a local sewage plant accidentally discharges wastewater without treatment to the ocean. It reduces average water quality index from 5 to 4 for one year. The income level is 8 and the actual cost per visit is 3. Please calculate the welfare loss due to the pollution accident.

6. (Question 2 on Page 215 in EE.)

In the Exxon Valdez legal case, several contingent valuation studies were part of estimates of liability damages owned by the oil company, Exxon. Damages were argued to include the value for all U.S. residents of an unpolluted Prince William Sound (where the spill occurred), bringing the issue of nonuse value to the front of the debate. Describe why a resident of the United States far from Alaska might associate real value (be willing to devote real resources) to a place he or she will never see or experience, such as coastal Alaska or the Amazon basin.