ECON4910, Spring 2011, Karine Nyborg

Seminar 6

Problem 1

Consider a society with 2 individuals. Assume that the regulator has normative views represented by an unweighted utilitarian social welfare function:

(1) $W = U_1 + U_2$

where W is the regulator's view of social welfare, and U_i is person i's utility. Moreover, let individual utility be given by

(2) $U_i = \ln x_i + b_i \ln E$

Here, x_i is person i's private consumption, while E is environmental quality (which is a pure public good).

The regulator is considering whether to go through with a project which will improve the environmental quality by dE=1. The total cost of this change is C=3. If the project is implemented, this cost will distributed equally between the two consumers, so that each pays C_i=1.5. Let initial environmental quality be E=100. Lump-sum transfers or side payments are not feasible (that is: compensation to losers, if any, will not be paid).

a) Assume first that b_i=2 for both individuals. Assume, moreover, that each person's initial private consumption level is 100. Calculate each person's willingness to pay for the environmental improvement associated with the project (assume that the project is marginal, and measure WTP in units of the private consumption good). Will the project be a Pareto improvement? Assume that the regulator knows individuals' WTP. Will a standard cost-benefit analysis conclude that the project is socially efficient? Will it increase social welfare, according to the regulator's view?

b) Assume now that initial consumption x_i differs between persons, and equals 25 for person 1 and 175 for person 2. What is WTP for each person now? Is the project a Pareto improvement, if the costs are still shared equally? Will the project be classified as socially efficient in a standard cost-benefit analysis? Will it improve social welfare? Give an intuitive explanation for your results, as compared to the results in a).

c) Assume now that initial consumption levels differ as described in b), and that, in addition, b_i differs between individuals in the following way: b_1=2, b_2=10. Costs are still to be shared equally. Will the project now be a Pareto improvement? Will it pass a standard cost-benefit test? Will it improve social welfare? Explain your results intuitively.

d) Assume now that the regulator knows neither the utility functions and its parameters, nor the WTP of each individual. Assume that the environmental change from the project discussed above is a decrease in outdoor noise levels in a densely populated area. Discuss which valuation techniques might be used to assess individuals' WTP in this case.

e) If the environmental change under consideration is, instead, an increase in the population of an endangered bird species in a remote, protected bird reserve without public access, would that affect your conclusions in d)? Discuss.

Problem 2

A consumer, Bill, purchases voluntarily a climate ticket to neutralize his extra CO_2 emissions when travelling by air. Assume that the cost of the climate ticket is substantial, given Bill's budget. Bill does not expect to be able to notice at all the improvement in global climate due to his own purchase of climate tickets, nor does he expect anyone else to notice this difference. However, he believes that if all air passengers did neutralize their CO_2 emissions by purchasing climate tickets, this would make a significant difference. Assume that the initial global climate, E^0, is considered exogenous by Bill. Can his purchase of climate tickets be explained by the following models?

a) Bill has preferences for his own private consumption (x_B) and a stable global climate (E), as follows:

$$U_B = u(x_B) + v_B(E)$$

where u and v_B are strictly concave and strictly increasing functions, and $v_B(E)$ reflects Bill's own benefits of a stable climate.

b) Bill has preferences for his own private consumption (x_B) and a stable global climate (E), as follows:

$$U_B = u(x_B) + v_B(E) + v_{-B}(E)$$

where u, v_B, and v_{-B} are strictly concave and increasing functions, $v_B(E)$ reflects Bill's own benefits of a stable climate, and $v_{-B}(E)$ his concern for others' benefit of a stable climate.

c) Bill has preferences for his own private consumption (x_B) and social approval (s_B) as follows:

$$U_B = u(x_B) + s_B$$

where $s_B = s(g_B)$, s is an increasing and concave function, and g_B = Bill's purchase of climate tickets.

d) Bill has preferences for his own private consumption (x_B) and social approval (s_B) as follows:

$$U_B = u(x_B) + s_B$$

where $s_B = g_B \cdot \alpha g_{-B}$, $\alpha > 0$, and g_{-B} is the average climate ticket purchase among other passengers on Bill's flight. Consider in particular the case if no-one else on the flight purchases climate tickets.

e) Bill has preferences for his own private consumption (x_B) and his self-image as a morally responsible individual (S_B) as follows:

$$U_B = u(x_B) + S_B$$

where $S_B = -\frac{1}{2}(g_B - g^*)^2$, and where $g^*>0$ is Bill's belief about the morally ideal climate ticket purchase for a person in his situation. (Consider g^* exogenous.)