ECOE 70312: Environmental Economics Problem Set 4

Professor Jensen Spring 2011

DUE: Wednesday, April 20

Consider the pollution/aid game in Chambers-Jensen with the following utility functions:

$$V^n = a(y^n - A) - (½)b(y^n - A)^2 - cE + (½)dE^2 + eA - (½)fA^2 - g(y^n - A)E,$$

where the contribution function is $C(A) = eA - (½)fA^2$, and

$$V^s = h(y^s + A) - (½)i(y^s + A)^2 + jE - (½)kE^2 - m(y^s + A)E,$$

where j is the parameter that distinguishes a tough Southern government from a weak one. Specifically, to capture the fact that it is more difficult for a weak South to enforce, we assume that j is either j_T or j_W, where $j_T < j_W$, so $\partial V^s/\partial E = jE - kE$ is greater for a weak South.

Finally, all constants a,b,...,j,k,m are positive.

1. Determine the Nash equilibrium (A^*,E^*) in a static game with certainty where North chooses aid to maximize utility and South chooses emissions to maximize utility.
NOTE: You only need to do this once. The equilibrium values differ for the two cases (South tough or weak) only in that $j = j_T$ when South is tough and $j = j_W$ when South is weak.

2. How do the equilibrium values of aid and emissions vary with the parameters e and j? Interpret these results.

3. How do the equilibrium levels of Northern utility and Southern utility vary with the parameters e and j? Interpret these results.

4. Now determine the Bayesian Nash equilibrium $(A^*(\alpha),E_T^*(\alpha),E_W^*(\alpha))$ in a static game where North chooses A to maximize utility and Southern types T and W choose E to maximize utility assuming it is common knowledge that South is weak with probability α.

5. How do the equilibrium values of aid and emissions vary with the probability α? Interpret these results.

6. How do the equilibrium levels of Northern and Southern utility vary with the probability α? Interpret these results.