Problem Set 4 - ECON2910
Legally Binding Environmental Agreements

Take the model in the lecture notes, but suppose that there is only one period, and no uncertainty/shock, and no technological spillover, so $e = 0$.

1. What is the difference between assuming $\delta = 0$ and assuming that there is only one period?

2. Given technology stocks, the R_i's, what is the socially optimal emission levels for each country i? (I.e., the g_i which maximizes the sum of surplus?)

3. Take now instead g_i as given (because they have been negotiated, for example). What is then the *equilibrium* level for R_i?

4. Instead of assuming that countries negotiate the g_i's but not the r_i's, suppose instead the reverse, that countries negotiated the r_i's efficiently, but the g_i's are noncooperatively chosen. Is this situation realistic? Beneficial? What is the equilibrium?

5. Consider now the dynamic model where $\delta \in (0, 1)$. For simplicity, suppose that the function $B(y_i)$ is so convex, or is kinked, so that the consumption level is completely fixed at some $y_i = \widehat{y}$ (so, B is not quadratic). In each period, what is the first-best level of technology investments? What is the first-best pollution level?

6. With the assumptions from question 4, can you show that there exists an MPE where R_t is the only (payoff-relevant) stock which strategies are conditioned on, and that in this equilibrium, every country is, at each point in time, investing the same amount as any other country? What is the equilibrium technology and pollution level in this equilibrium?

7. For which discount factors are the first best, derived in 4, possible to sustain in a SPE? Assume here that the players can use trigger strategies where the punishment (after a country does not cooperate) is that the countries revert to the MPE in the game.