

ECON4910 Environmental Economics

Spring 2017

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Problem set 5

Ex. 1. Deforestation.

Use the model presented in class, based on Harstad (2016) of illegal logging (set $b = 0$), but suppose there is a single country ($n = 1$) and no donor. Also, suppose the government cannot have a different expected penalty in one part of the forest than in another: The expected penalty must be θ everywhere.

1. How does the uniform (!) level of θ influence x ?
2. What is the optimal θ ? What utility will the country C then get?
3. Suppose the country has two distinct forests of equal size, A and B, and that θ_A and θ_B can be different, but the expected penalty must be the same within each of these two forests. When is it optimal that they differ, and what should they be?
4. Suppose the country's forest can be divided up in any way you want, and that in unit j of the forest, θ_j can be set different than in any other unit. Derive the optimal θ_j , explain why (if) they may differ in j , and derive the country's utility. Compare that utility to the utility in (2) and (3) and explain why it is higher:

Ex. 2. Discounting

Assume a CRRA utility function with:

$$u_t = 2\sqrt{c_t}$$

and suppose consumers maximize $\sum_{t=1}^{\infty} \delta^t u_t$ with $\delta = 0.9$

1. What is the discount rate on utility?
2. How much should one discount future consumption, if the growth rate of consumption is 2% a year?

3. Suppose there are two groups in the society. Half of the population are patient and have $\delta = 0.99$, while the other half is applying discount factor $\delta = 0.90$. Suppose you want to maximize the sum of today's welfare (present discounted value). What is the max amount you, as the planner, would be willing to invest/pay today if the value is worth 100 consumption units in 50 years? Which annual discount rate does this correspond to?
4. What is the answers to (3) if instead the 100 consumption units are materialized in 100 years, not 50 years?
5. Discuss informally how you think your answers would change if there is uncertainty about the consumption growth rate
6. Also discuss how the answers would change if the consumption growth rate is certain, but it is quite uncertain whether the investment will give 100 consumption units

Ex. 3. Time inconsistency

Suppose a generation can choose its consumption level by maximizing:

$$U_t = u_0 + \beta \sum_{t=1}^{\infty} \delta^t u_t \quad (1)$$

where $\beta = \delta = 0.9$. Suppose there is only three periods, period 0, 1, and 2, and:

$$u_t = c_t - \frac{1}{2}G_t^2 \quad (2)$$

where $G_t = G_{t-1} + c_t$ and $G_{-1} = 0$.

1. If one can commit in period 0 to all future consumption levels, what is the optimal c_t for each period?
2. If one cannot commit in period 0, what is the equilibrium values of c_t for each period?
3. If one cannot commit in period 0, will generation 0 choose c_0 strategically? In which sense, and to influence which choice?

References

Harstad, B. (2016). Deforestation and REDD contracts. Lecture note, University of Oslo.