

Econ4925 – Seminar 1: nonrenewables

Single resource owner (‘Gray’s problem’)

A single profit maximising owner of a non-renewable resource commands a known fixed stock of S_0 and takes the price p as given and constant. R_t denotes the rate of depletion and the interest rate is r . How long to extract (T) is up to the owner.

1. The cost of extraction is $b = b(R_t) + B$ where $b' > 0$ (a u-shaped cost function).
2. Alternatively, the cost function is $c = c(S_t)R_t$ with $c(S_t) < 0$ (constant in R_T and increasing in the extracted amount).

Solve for each case the problem of the resource owner. Support the formal analysis by economic intuition.

Competitive market

A competitive market for a non-renewable resource has a total stock S_0 , distributed among profit maximising resource owners. Extraction costs are zero, the discount rate is r and extraction is denoted R_t . Demand for the resource at t is $D(p_t) = e^{gt}p_t^{-\epsilon}$, with $\epsilon > 1$ and $g < \epsilon r$. The duration of extraction (T) is indeterminate.

3. What characterizes the market price path?
4. Derive p_0 and R_0 as functions of S_0 and the other exogenous parameters.
5. What are the effects on price and depletion profiles of:
 - (a) an increase in r ?
 - (b) an increase in S_0 ?
 - (c) an increase in g ?